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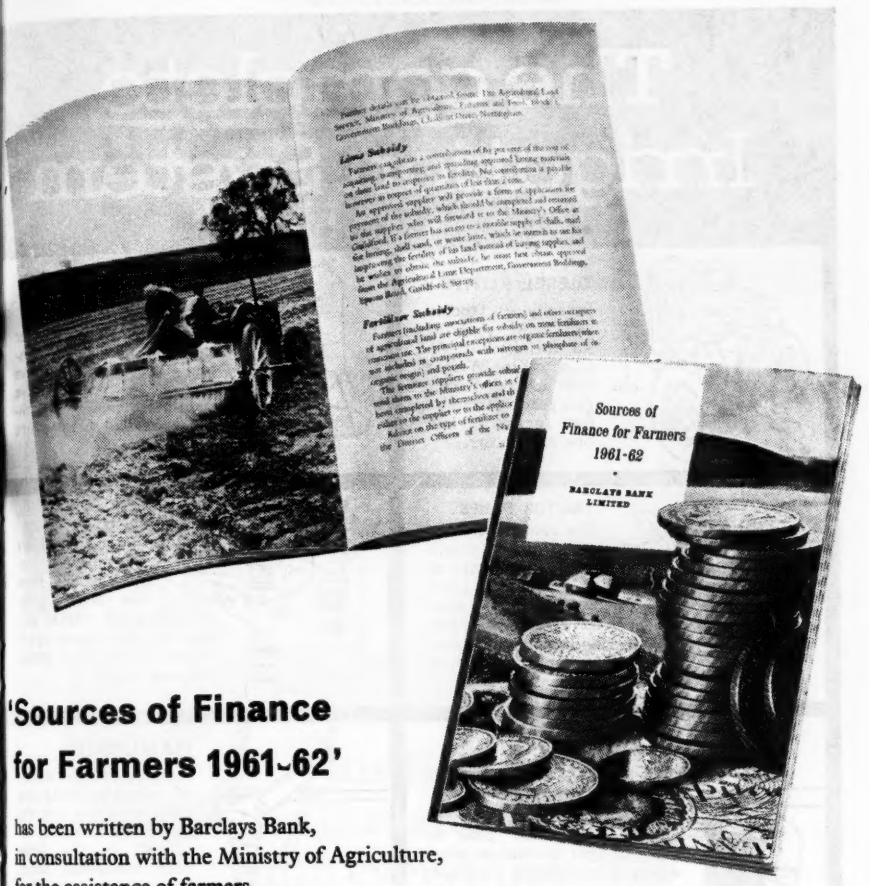

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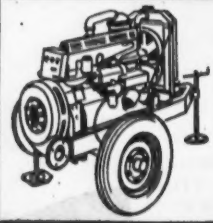

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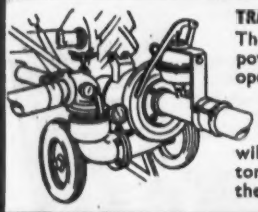

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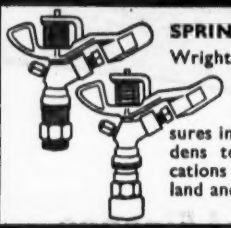

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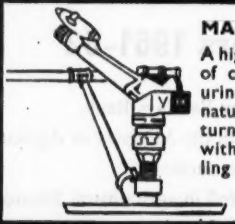

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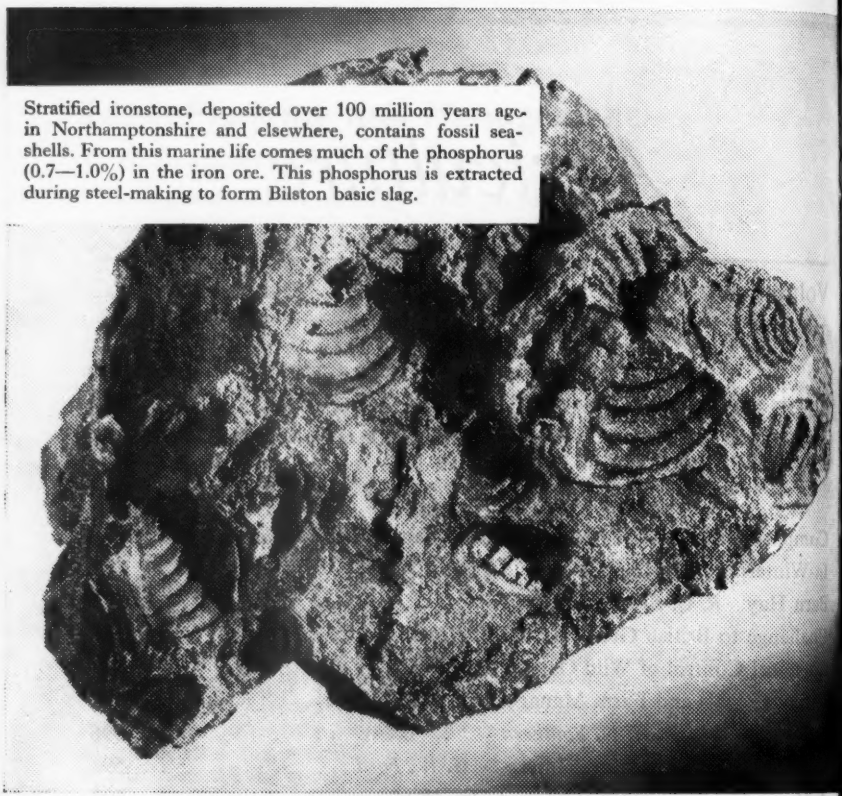

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Comparing the Cost of Mechanization Changes

C. CULPIN, O.B.E.

Chief Farm Mechanization Adviser, National Agricultural Advisory Service

Mr. Culpin outlines the general management principles which must always be borne in mind when considering mechanization changes and goes on to give some examples of how they may be applied to specific problems.

WHEN it is desired to compare the cost of owning and operating different kinds of farm machinery, the simplest forms of budgeting, which assume that the labour force and fixed tractor costs remain unaltered, are often unsuitable. It is usually necessary to determine not only the "ownership" and operating costs of the specialized equipment that is under consideration, but also the effect that using the equipment will have on power and labour costs. Nevertheless, in making these calculations, due regard must be paid to certain elementary facts which always influence management decisions. For example, small savings of labour in a relatively slack time are of little practical value. On the other hand, any savings which can be made at times of peak labour requirements are very important, especially if these savings enable the number of men needed at such times to be reduced. Similarly, a saving in tractor hours, which makes a tractor last longer, is always of some consequence, but the really important savings are those occurring at times of peak tractor use, particularly if they enable the farmer to get the work done effectively with fewer tractors as well as fewer drivers. *These over-riding management considerations must always be borne in mind when studying the effects of mechanization changes.*

Machine costs can be roughly divided into two parts, namely the "ownership" or "fixed" costs, including such items as depreciation and interest on capital, which do not usually vary directly with the amount of use of the machine, and the "variable" or "running" costs, such as fuel and repairs, which are usually more or less directly related to the amount of use.

Depreciation and interest

Depreciation charges often represent the major item in the total cost of owning and operating machinery, and as there are no hard and fast rules about methods of estimating depreciation costs, particular attention must be paid to this item whenever equipment changes are being considered.

Depreciation charges consist of two main elements. First there is the "wear and tear" element. A machine's working life will depend to a considerable extent on wear and tear, and will often be much shorter for fully-used machines than for those which do only a little work each year. In the case of fully-used machines which are worn out within a few years of purchase, it is reasonable to arrive at an annual depreciation charge simply by dividing the purchase price by the machine's working life. This procedure, however, does not take account of the second factor, namely obsolescence. Little-used machines are often obsolete before they are worn out, or farming

policy may change, so that the machine is no longer needed for the purpose for which it was bought: or, to put the matter in another way, the capital invested in the machine may be needed for another purpose before the machine is worn out. For these reasons it is advisable to vary the annual depreciation charge according to the use made of the machine, but to avoid basing a depreciation charge on a period of more than twelve years, even though it is fairly certain that the machine will not be worn out in this period. Suggested rates of depreciation for various main groups of machines and levels of annual usage are:

		Light use	Normal use	Heavy use
1. Machinery used very intensively or new type of machine likely to become obsolete quickly	rate per cent	16½	20	25
	years	6	5	4
2. Large machinery with many moving parts, combine, baler, tractor, forage harvester. sugar beet harvester	rate per cent	8½	12½	20
	years	12	8	5
3. Simple implement—cultivation equipment, trailer, etc.	rate per cent	8½	8½	10
	years	12	12	10

There is no general agreement between agricultural economists on the inclusion of "interest on capital" as a charge in budgeting mechanization changes. The reason for including it is that money spent on mechanization is not, of itself, productive in the same way as money spent on livestock, seed, fertilizers, etc. Mechanization is simply a means of carrying through a given production programme, and normally, to put the matter in its simplest form, there is some degree of choice between investing money in equipment and spending it on labour in order to get the given job done. So, where one way involves a large expenditure on equipment and little on labour, and another involves a great deal of labour with little or no equipment, interest is charged on the money locked up or borrowed to provide the necessary equipment. In the examples given in this article, interest is charged at 5 per cent per annum on half the capital cost.

Repairs and spares

Repairs are a major item in the variable costs. Unfortunately, information on repair costs is scanty, so a farmer's own estimates, based on his records for comparable equipment, are as good a guide as any. The hourly cost of repairs and spares may be estimated as a percentage of the purchase price. Figures range from ·12 per cent per hour for such equipment as tillage implements and potato elevator diggers used in very abrasive soils, to only ·01 per cent per hour for tractors. With good maintenance it is possible to improve on the lowest figure. Much farm equipment falls about half-way between these extremes at ·05 to ·06 per cent per hour. A simplified figure suggested for normal use of machines with a limited working season is 3 per cent of the purchase price per annum; but this is not high enough for machines which are fully used and require many replacement parts, e.g., ploughs; or for machines used over a very long season, e.g., tractors.

Harvesting potatoes

The application of these general costing procedures is best explained by examples, and the first one given is choice of equipment for harvesting 40 acres of potatoes on a farm where, from a technical aspect, a mechanical harvester can be used.

Using as a basis some of the results recorded at the 1961 National Potato Harvester demonstration, we find that single-row trailed harvester "A", costing £695, with 3 operators, worked at ·265 acres per hour; 2-row harvester "B", costing £995, with 5 operators, worked at ·428 acres per hour; and a picking gang of 14, working behind an elevator digger (price £200), worked at ·320 acres per hour.

These figures are used in the following calculations merely as examples, and it should be emphasized (*a*) that the figures themselves apply only to a single set of observations, and as such should not be applied indiscriminately; and (*b*) it is assumed only for the purposes of this exercise that such factors as crop losses, crop damage, and transport problems are the same for each method. With these reservations in mind, and assuming that all methods are capable of getting the work done (another question that needs some thought in practice), we can calculate the labour and machine costs of lifting the 40 acres as follows:

Annual cost of labour and machinery for harvesting 40 *acres*

	Hand picking 2+12 pickers	1-row harvester 1+2 pickers	2-row harvester 1+4 pickers
HOURS OF USE	125	151	93
FIXED COSTS	£ *s.*	£ *s.*	£ *s.*
Depreciation			
Basis "normal" use. 8-year life for elevator digger and 5-year life for both harvesters (obsolescence factor)	$\frac{200}{8}$ = 25 0	$\frac{695}{5}$ = 139 0	$\frac{995}{5}$ = 199 0
Interest on capital			
5 per cent p.a. on half capital cost of specialized equipment	5 0	17 7	24 17
Housing, insurance, etc.	1 0	3 0	5 0
RUNNING COSTS			
Repairs of specialized equipment at ·10 per cent of capital cost per hour for elevator digger: ·06 per cent for harvesters	25 0	63 0	55 10
Tractor cost at 5*s.* per hour	31 5	37 15	23 5
LABOUR COST			
Pickers at 4*s.* per hour net (casual labour)	300 0	60 8	74 8
Tractor drivers and foreman at 4*s.* 9*d.* per hour (permanent staff) net	*(59 8)	*(35 17)	*(22 2)
Total of casual labour and equipment costs (lifting only)	387 5	320 10	382 0

*Excluded from totals

Although it is accepted practice in modern budgeting techniques to exclude the permanent labour element from the calculations, it is often worth while, as in this case, to note differences in the calls made on the permanent staff by different systems, since one of the most important advantages of new mechanized methods lies in ability to reduce the number of permanent staff needed for the job, or the amount of time that it takes. This can be very important at a peak period of labour need such as the normal time for potato harvesting.

The 1-row harvester appears to be the best choice, but it should be borne in mind that it requires a rather longer working time of 151 hours, and that the 40 acres is near its capacity in an average season. It has the advantage of needing the smallest picking gang. If the gang is available to operate the 2-row harvester, the shorter season of use might be an advantage. Alternatively, the spare capacity of the 2-row machine might be put to use on a somewhat bigger acreage. Where there is a shortage of either permanent or casual labour and the harvesters are technically efficient, even the under-employed 2-row harvester is preferable to the hand-picking method. The importance of the harvester lies in its ability to get the work done without much demand on casual labour, which is likely to become increasingly scarce; but the possibilities of adverse harvesting conditions should not be overlooked.

Silage-making on a small farm

A second and simpler example deals with finding an effective and economic way of making 100 tons of silage, the produce of 20 acres of ley laid up for a short period.

In the past, it would have been useful to compare the cost of doing the job by forage harvester with the buck-rake method, but the forage harvester method has so many advantages that most farmers today are no longer interested in using the mower-and-buck-rake technique. It is therefore of more interest to compare the cost of sole ownership of a small forage harvester with the cost of sharing its use with one or two neighbours. N.A.A.S. investigations have shown that when a small forage harvester is used in an average crop yielding 5 tons per acre at a transport distance of just over ¼ mile, average loading rate is about 7 tons per hour, and the overall system rate for a 2-man team, with one man using a buck-rake at the silo, can be reckoned at just under 5 tons per hour. The capital cost of the specialized equipment needed is about £275 for the forage harvester, £40 for the buck-rake, and say £45 for high trailer sides—a total of £360.

A hundred tons of silage requires only about 20–25 hours' work, usually spread over about 4–6 days; and it will make little difference to the life of the equipment if it does two or three times as much annually. The equipment is, in fact, capable of doing well over 600 tons a year if fully used. An estimate of the life and depreciation charges for various "light" and "normal" levels of usage is:

Tons ensiled annually	Approx. hours of work	Estimated life (yr)	Annual depreciation cost (£)	Annual interest charge (£)
100	20	12	30	9
200	40	11	33	9
400	80	10	36	9

The farmer with his 100 tons to ensile may therefore have a choice between sole ownership and sharing the use of a machine as follows:

	Total of depreciation and interest charges
Sole ownership	= £39
Half share with one other	$\frac{£42}{2}$ = £21
Quarter share with 2 or 3 others	$\frac{£45}{4}$ = £11 5*s.*

With this inexpensive equipment, the differences are not big enough to worry some farmers, but a good case can be made for sharing where usage is so small. An important advantage enjoyed by the farmer who shares with 2 or 3 others is that the equipment can be written off more quickly, giving more opportunity to keep up to date with new and improved models. Moreover there are considerable advantages in official syndicate schemes in that no large amount of capital has to be found even at the outset. Hourly running costs are unlikely to be much affected by the different levels of usage considered.

Complex mechanization problems

It is much more difficult to assess the financial effects of mechanization changes where introduction of the new system results in several completely new procedures. For example, some farmers are interested in comparing self-feed silage made by a flail forage harvester in a horizontal silo, with mechanically-fed silage made in a tower silo. Here, so many assumptions have to be made, including such questions as the life of various types of silos, and the levels of nutrient losses, that cost calculations can do no more than indicate whether proposed changes are reasonable or impossibly expensive.

In such cases it is usually best to isolate the various main factors and make separate calculations for each. Thus, in the comparison of self-feed and mechanically-fed silage, we can, without going into any great detail, list some of the more important factors and questions in relation to the particular requirements. Suppose, for instance, that it is required to make and feed 400 tons of silage. It is known that this can be done effectively by a 3 or 4-man team using a cheap and simple flail forage harvester, in horizontal self-feed silos housed beneath a Dutch barn. As regards making the silage, the only difficulty is some danger to the operator who uses a buck-rake to distribute the tipped loads or crop on to the silo. Changing over to a tower (or box) silo involves the following disadvantages, without any substantial advantages at this stage:

Job	*Comment*
Cutting and loading	The full-chopping forage harvester costs much more than the flail type, has more wearing parts, and gives little or no greater working rate for a given power input.
Transport	The moving-bed trailers, which are almost essential, cost much more than hydraulic tippers, have more wearing parts, and do not necessarily have a higher working rate.
Ensiling	The blower needed to fill the tower silo is rather expensive, though if electric-motor-driven it has some advantages over the buck-rake system.

In typical examples, the comparison of total equipment costs for the flail and full-chopping systems may be about £750 for the flail system, and £2,250 for the full-chopping system (excluding tractors in both cases). It is easy to see that the depreciation and interest charges for the full-chopping system represent a sizeable problem.

The next main part of the problem concerns the silo itself. Here it is necessary to take account of the capital cost, life of the silo, and effect on nutrient losses. Some information on levels of nutrient losses in various types of silos is available from recent experimental work at the Ministry's Experimental Husbandry Farms, but limitations of space preclude discussion of results here. Suffice it to say that, though nutrient losses in tower silos may be considerably reduced compared with those in typical horizontal silos, it is difficult to justify the cost of the more expensive types of towers simply on this basis. Losses depend more on the effective exclusion of air than on any other factor, and if sufficient trouble is taken, this can be achieved fairly cheaply by the skilful use of polythene sheeting in conjunction with concrete-walled horizontal silos. Nevertheless, a good tower silo can make it fairly easy to secure a high level of efficiency in conservation; and if, for example, its use results in a reduction of dry matter loss of 5 per cent, the total saving on 400 tons of wilted silage, ensiled at 30 per cent dry matter, would be 6 tons of dry matter. If this is valued at say £20 a ton, the amount saved could be about £120. Possible gains are greater where the system with which the tower is compared is very wasteful.

The third main comparison is in feeding the silage. Here the whole subject of silage feeding needs to be studied, and some of the important questions still remain unanswered. Little is known at present about levels of waste with various methods of mechanical feeding, though it seems likely that mechanical feeding can improve on self-feeding in this respect. The cost of equipment for mechanical feeding may be considerable. Where a mechanical silo unloader is used, the rate of work is slow, so that auger feeding may also be desirable, and the total cost of the feeding equipment may be in the region of £1,000, even with a simple top-emptying silo unloader. It is obviously difficult to justify such expenditure on a farm where self-feeding is or would be satisfactory, and it does not require detailed calculations to show that the successful application of completely mechanized silage-feeding calls for a very full use of all the equipment involved. Equipment costs which would be prohibitive for a unit feeding 400 tons of silage might, however, be justified in a highly specialized unit where 1,000 tons or more is fed.

Enterprise planning and mechanization

Enterprise planning based on "gross margins" does not necessarily call for mechanization budgeting as detailed as that outlined here. Usually it will be adequate to consider only the fixed charges on the specialized machines, and to decide the effects of any changes that are envisaged on the need for tractor power and labour in peak periods. A proposed method which shows a substantial labour saving during a peak period may make possible a reduction of labour over the whole year, and the effect of this can sometimes be much greater than would be indicated by detailed cost calculations based on the number of labour days actually saved. Similar considerations apply to tractor usage. The saving of a few hours of tractor work is relatively

unimportant; it is only if a particular project calls for extra tractor work which will necessitate increasing the total tractor strength of the farm that the question assumes serious proportions.

One of the chief needs in overall farm planning is knowledge of the working rates and the best operating systems for the machines concerned. This will show how many workers are needed to get the job done, and what tractors, trailers and ancillary equipment are needed. Unfortunately, not much is known about field capacity and the best operating system for many of our modern machines. It is to be hoped that operational research, surveys and official testing will in future contribute more data to facilitate mechanization management calculations.

In-Wintering of In-Lamb Ewes

STANLEY CULPIN, M.Sc.

Director, Drayton Experimental Husbandry Farm, Stratford-on-Avon

This article appears rather out of season, but its account of an exercise undertaken at Drayton to assess the possibilities of housing in-lamb ewes indoors during the winter will be of interest for future planning.

THERE are so many different and equally successful methods of wintering lowland ewes that it would be wrong to be dogmatic. It is not suggested that the methods described in this article are the only ones or the best ones, but whatever their value they apply particularly to clay land in the Midlands, where the winter period is very much more difficult than the summer.

In the ordinary way, the level of winter feeding depends on such things as the size of the ewes, whether they are likely to be carrying twin lambs or singles, and the carrying capacity of the grazing. This last factor is very important and very variable. Grazing is not usually sufficient by itself, and this is not unexpected because grass growth is at its minimum just when the unborn lambs are growing fast. In some flocks the total weight of lambs at birth will average nearly 20 lb per ewe and individuals will produce nearly 30 lb per ewe.

Experiments and experience have shown that good nutrition during the last six weeks of pregnancy has a beneficial effect on the health of the ewe and the weight and vigour of lambs at birth. The recommendation to feed a corn ration is based on this evidence. On some farms grazing plus a supplement may be enough, but usually some fodder is also essential. There is some controversy about the rival merits of roots and hay and silage, but so far as the two last-named are concerned it does not matter so much whether hay is fed or silage; the important thing is that the hay or silage should be of good quality. At Drayton, hay alone, silage alone and a mixture of the two, have

all been used successfully and it is normally expected to put the racks out some time in December for a half-bred flock which begins lambing at the end of February.

Before considering in-wintering, it is relevant to mention the total quantity of food used out of doors when it is necessary to restrict the area devoted to winter grazing. In the 1960/61 winter, Scotch half-bred ewes consumed 2¼ cwt of hay per head where they were stocked at 4½ ewes per acre and 2 cwt of hay per head at 3 ewes per acre. In addition to this, both groups were given ½ cwt per head of corn before lambing. It was a relatively open winter and there was a useful bite on the field when they were turned in on 9th December.

Housing ewes indoors

In the autumn of 1960, Mr. Maurice Passmore, Chairman of the Drayton Farm Advisory Committee, suggested that it would be helpful for Midlands flockmasters to know whether they could keep their in-lamb ewes indoors during winter if they so wished. Mr. Lyle Stewart was brought into the discussions, and his advice is also gratefully acknowledged. As a result, it was decided to house a flock of 84 ewes during the worst months of the winter, there being two main reasons for doing so. In the first place it is obvious that on a clay farm management indoors is easier than out of doors, having regard to the labour involved and the difficulties associated with fields and gateways churned up by transport. Secondly, there is a good chance that land not grazed in winter, particularly in January and February, will carry more stock in the following spring than land that has been grazed and poached. There is very often a period in April when good grazing is more important than at any other time of the year.

Preparations were made in a Dutch barn. Three bays, each 15 feet × 24 feet, were made into three pens, and slatted floors were constructed in 8 feet × 7 feet 6 inch panels for two of the pens, the third being littered with straw as necessary. The slats were nailed to joists which were supported on main beams, thus raising the floor to a height of 2 feet above ground level. Special hay-racks were designed both to prevent wastage and to avoid littering the slats, the principle of the racks being that all the hay has to be pulled through a horizontal strip of weldmesh only 4 inches wide and of 3 inch × 2 inch mesh. Some floor panels were made of 1½ inch-wide slats ¾ inch apart, and others of 3 inch-wide slats at the same spacing. Both types subsequently gave good results, and other widths would doubtless be just as satisfactory between these limits. It is not considered that they need be specially shaped or even planed, but they ought to be made of hardwood if they are to last. The ewes were housed on 9th December.

Exercise and feeding

Bringing ewes indoors in December posed the question whether they would take sufficient exercise in a confined space and at a stage when exercise is usually considered important. To obtain information on this point, one-third of the ewes were taken for a walk each day, but no difference was detected in health or performance due to this treatment.

Another question was whether indoor ewes would become over-fat and,

if so, whether it would be necessary to restrict their fodder. On the other hand lack of fodder might lead to malnutrition. The fodder consisted of a good sample of barn-dried hay which had been taken from an old pasture. The field was grazed very hard in the New Year with a flock of ewes which lambed there during March. Recovery was slow, but a 50-cwt-per-acre crop was cut on 30th June at the early flowering stage, so that the hay was not of the highest quality but it was well made. From analysis the starch equivalent of this hay was estimated at 41 per cent of the dry matter. It was thought that, with this quality, the ewes would not be likely to become over-fat and, therefore, they were given as much as they would eat throughout the three months that they were on trial.

It was found that they consumed 4½ lb per day before the corn feeding period and a little less after it, or 3½ cwt plus their corn in 99 days. From what has been written above about outdoor ewes, it will be noted that they used 1 cwt per ewe more than those run at 4½ per acre on pasture. Supplementary concentrate feeding began on 16th January at ½ lb per head, this being increased to 1 lb on 15th February and to 1½ lb on 2nd March. The average lambing date was 18th March, so that the average consumption of concentrates was 57 lb per ewe.

Throughout the period the animals had free access to clean water and mineral licks, and the concentrated food was also fortified with a mineral mixture. All ewes were injected with 1 c.c. of a Vitamin D preparation on 22nd December but what effect it had is not known.

Performance data

Over a period of 99 days the ewes gained in live weight by 7 lb per head (i.e., the difference between weight on 9th December and weight immediately after lambing). At the same time each ewe produced an average of 1·88 lambs, each weighing 9·9 lb (18·5 lb per ewe).

There is not much information about the requirements of a pregnant ewe kept indoors: most of the data apply to the production of meat on grass or folded roots. But the total appetite is given in *Rations for Livestock*, M.A.F.F. Bulletin No. 48, and the ewes which weighed 164 lb apiece in December ate only slightly more than the predicted amount, which is equivalent to 33 lb of hay per week or about 1½ cwt of silage. From a knowledge of the feeding value of the hay and the corn, it was calculated that the quantity of energy in the ration produced just about the expected result and the quantity of protein was exactly equal to the theoretical requirement.

Conclusions

It is concluded that, in spite of the considerable quantity of hay and concentrates used, the indoor ewes were not over-fed, and there was some support for this belief when one considers the performance of the out-wintered ewes. They also had access to all the hay they required as well as any grazing that they could find. They produced the same satisfactory lamb crop (1·86 lambs per ewe) but their lambs were 1½ lb heavier at birth and the ewes were 10 lb heavier after lambing.

At the end of the first season it is impossible to make any general recommendations, but perhaps it is permissible to speculate what might have happened if the indoor ewes had been kept short of hay; or if the hay had

been a little poorer (it was good hay by any standard and very good by some); or if the concentrate ration had been halved. The chances are that there would have been malnutrition in the later stages of pregnancy with who knows what results. The moral with indoor sheep is not to over-feed but to realize that they eat more than might be expected and when they are wholly dependent for what they have, it must be supplied. A few farmers have already tried in-wintering ewes in spare buildings and have not been disappointed with the results. Others may follow their example and, if so, it is suggested that the level of feeding should be given very serious consideration.

The following table summarizes some of the salient points.

	Indoor ewes (12 sq. ft per ewe)	Outdoor ewes (4½ ewes per acre)
Weight on 9 Dec. (lb)	152	152
Weight after lambing (lb)	159	169
Lambing percentage	188	186
Lamb birth weight (lb)	9·9	11·5
Hay fed (cwt)	3·5	2·5
Concentrates (lb)	57	57

Barn Hay

R. G. Scott

Electrical Development Association

Making good hay at the touch of a switch is worth thinking about in our unpredictable climate.

In-barn drying has advanced considerably since it was pioneered by the electrical industry in the early fifties. Its value to the stock-keeper, however, is still not universally appreciated. Farmers throughout the country who have adopted it consistently secure palatable, nutritious fodder. Indeed some former protagonists of all-silage feeding have gone over completely to artificial drying—others find a judicious combination of both enables them to obtain the maximum benefit from their grass crop.

Developments in techniques have been along two distinct but related lines—the batch method, and the storage method. Both, whether for loose or baled hay, are based on generous airflows for forced ventilation. Although this can be achieved by alternative equipment, comments will be confined to electrical methods—now well proven in the field.

Principles and design features are dealt with fully in EDA publication No. 1924*, but it may be worth while to review the fundamentals. Obviously ease of handling bulk quantities makes drying in the bale more attractive, and therefore bale-driers will be our primary consideration. Driers designed for the purpose will, however, deal with loose material equally well, and this

*Farm Electrification Handbook No. 7, *Green Crop Drying*—free from Electricity Boards or from EDA, 2 Savoy Hill, London, W.C.2.

is an advantage when considering a succession of cuts starting with really early growth.

Field operations

Sound field technique is important to ensure quick and even wilting before baling. The aim should be to wilt down to below 45 per cent moisture content as quickly as weather and available machinery will permit, so avoiding over-exposure, weathering and loss of leaf. As soon as the herbage is cut, early and repeated movement of the swath should be carried out by tedder, aerator and turner. This early and continued movement cannot be over-emphasized; it is false economy to stint these operations. Where economically justified a crimper also helps wilting. Many farmers leave the swath untouched for too long. The aim should be to get it well "fluffed up", to facilitate even drying by natural ventilation. Naturally, the time taken to achieve this initial moisture reduction possibly from 80 to 45 per cent will vary with the nature of the crop, prevailing weather and the amount of mechanical treatment given. Baling can, however, usually be started within 24–48 hours after cutting.

Most modern pick-up balers will handle hay at 45 per cent moisture content, but it is essential that the density be kept to around 12–13 lb per cubic foot. At this moisture content and density, a 36 in. × 18 in. × 14 in. bale should weigh no more than 70 lb. Bales of 27 in. to 30 in. are less tiring to handle; their weight before drying is only 56 lb, which is dried down to 40 lb. Rotobales, too, can be dried successfully, stood on end two and three layers deep in batch driers. Once the wilted herbage has been put into bales, it should be carried to the drier so that ventilation will prevent internal heating.

Batch drying on mesh floor

Basically, both batch and storage driers consist of a walled barn, or section of a barn, with a flat false floor (usually welded steel mesh) supported 24 inches above ground level on timber bearers. This forms a plenum chamber into which the ventilating air is blown, an 18 inch-wide blanking-off strip round the outer edges preventing leakage up the side walls, which must be airtight and reasonably smooth. Convenient loading and unloading doors are provided by drop-in panels to fit flush with the inside surface of the walls. A height of 10 feet is adequate for a batch drier, the drier being loaded and emptied for each batch.

Ventilation for bale drying requires an airflow of 45–50 feet per minute against a back pressure of 2·5 inches w.g. Some warming of the air is necessary for economic throughput, and this can be done by using sufficient heat for either a continuous temperature rise of 5°F or alternatively 10–15°F in the final stages of drying—following a cold blowing period. The latter is commonly referred to as "high/low" drying, being a two-stage process originally developed for drying loose young leafy herbage. A simple back-pressure indicator, or "U" tube, should be fitted to ensure the desired airflow from the fans' designed operating capacity.

Bales should be carried as soon as a sufficient batch quantity is available, and packed tightly into the drier, each successive layer being laid at right-angles to the previous one, so creating a "cross-bonding" effect. Loading

should be restricted to 4-5 layers, and blowing should start as soon as the first layer is complete. For "high/low" drying, cold air should be continuous for 5-6 days, followed by a further 24 hours using warmed air. Before moving the bales to store they should be ventilated with cold air for half an hour.

On average, the drying time for a batch is 6–7 days, and the drying cost ranges from 15*s.* to 25*s.* a ton of dried bales.

Batch drying in tunnels

Drying in tunnels developed from the success of the same method of drying grain in sacks; and indeed it serves the dual purpose. Ventilation requirements are similar to those in the batch floor method, warm air being used in the final stages of drying. Driers can be designed either for single- or multi-tunnel operation, the latter providing flexibility where large quantities of bales are concerned. Single-tunnel drying can be done by simply fixing a suitable fan to an air inlet made in a wall of a barn, the bales being built up on the opposite side. Multi-tunnel working entails a little more constructional work, by the provision of an air-duct with the desired number of 2 feet × 2 feet shuttered openings at 15 feet intervals.

Immediately the hay has been baled it should be built into "tunnels" (hollow clamps into which the ventilating air is blown) and ventilating started. The drying programme is similar to that for the batch drying method already described. Satisfactory tunnel building entails more care than stacking bales in a drying bay with a mesh floor, but on the other hand the drying area is free for use by live or dead stock after drying is finished. Drying costs for bales under the tunnel process range from 20*s.* to 30*s.* per ton under average conditions.

Batch drying, while enabling a planned programme to be undertaken, entails double handling. This can, of course, now be eased by mechanical bale handling equipment and tumble storage, but some farmers do not like it, particularly if the drier is not needed for grain.

Storage drying

An alternative method, where suitable buildings are available, is the storage system. In this, successive loadings are made at intervals of 2–3 days, the bales being left until they are required. To give an economic output, the building should be as high as possible; 16–18 feet is about right, to accommodate up to 12 layers of bales. The false floor, constructed as for the batch drier, must be suitably supported to carry the heavier load involved, and all walls and doors should be made airtight.

The ventilation requirements are a minimum of 40 feet per minute against a back pressure of 2·5 inches to 3 inches w.g. Unlike batch drying, no timetable is involved; unheated air provides adequate drying, even at 1,000 feet above sea level. In areas or seasons of high humidity, however, some operators prefer heating provision to achieve a temperature rise of up to 5°F for a measure of humidity correction. This is simply done by a heater bank of appropriate loading.

Hay baled at below 45 per cent moisture content should be loaded into the drier immediately and ventilation started as soon as the first layer is complete.

Three or four layers can be loaded on the first day, and similar loadings added every 2–3 days until the drying chamber is full. Blowing, once started, must be continuous to avoid any heating in the bales and, under average conditions, should last for up to 10 days after the final filling. Thus where the barn accommodates four successive loadings, drying will take up to 3 weeks.

Storage driers can consist of a single drying bay or multiple-bay installations ventilated by two or more fans. This system, using no, or little heat, is very economical in operation; drying costs range from 10*s.* to 20*s.* a ton dried.

What do you want?

Some of the practical factors which must be taken into account before choosing a drier are: quantity and quality of hay required; building availability and suitability; labour and machinery; locality; multi-purpose aspects. These points are discussed at length in the booklet previously mentioned and should be studied carefully, for driers can be tailor-made to individual requirements for any size of farm. The selection of equipment is largely governed by the system chosen, capital cost and capacity and type of electricity supply available. Axial flow and centrifugal types of fan are equally suitable for barn hay drying, although there is considerable variation in the power required for different duties; also in the running costs.

Axial flow fans have electric motors directly coupled and built into the fan casing. Thus they are highly efficient, compact and particularly suitable for installation in a small space. Where the duty required is beyond that of a single stage fan (more *pressure* being needed), it can be met by a two-stage model—i.e., two fans in tandem in one casing. Where greater *volume* is needed, two or more fans can be installed in parallel. A disadvantage of this type of fan is its high noise, which can be disturbing if the drier is sited near a house.

Centrifugal fans, although larger and rather less efficient than the axial flow type (having a higher horse-power requirement for a given volume), are quieter running. The backward-curved, non-overloading type is especially suitable for barn hay drying—and it is just as useful too for in-bin grain drying if there is suitable ducting.

Heaters are normally supplied by the fan-makers and matched to give the desired temperature rise to the rated airflow.

What will it cost?

The cost of constructional works naturally varies considerably, depending on the method of drying chosen, the initial adaptability of the building and what can be done by direct labour. But here is a guide to fan costs:

Floor area	Cold air drying	High/low including heater
sq. ft	£ £	£ £
100—150	not applicable	120—200
150—250	75—120	190—280
250—300	80—120	280—370
300—400	100—190	370—480
400—600	150—250	470—670

Taking examples of batch and storage driers both designed to dry 80–100 tons of bales a year, *total* capital costs were about equal—around £10 a ton. Both cases involved the necessary walls and flooring to provide two drying bays, each of about 300 sq. feet, within the roof and stanchion structure of Dutch barns. Grant-aid was applicable to the building works in each case, as with all Government-approved schemes.

Where existing walled buildings are available and can be adapted, capital costs are naturally much less. Internal divisions of plywood or hardboard, suitably supported by timber framing, are adequate—and they reduce costs, as do alternative flooring materials which can sometimes be picked up cheaply.

Economics of in-barn drying

Even under average conditions, losses in the field with swath-drying can amount to 25 per cent of the dry matter of the original crop as cut. Under similar conditions trials, since confirmed on farms, have shown that an extra 4 cwt of dry matter for every ton as cut can be conserved by barn hay drying. This additional 20 per cent alone may well more than cover the whole cost of drying, quite apart from increased *quality* value.

Feeding trials comparing average quality barn-dried hay with similar material swath-dried showed increases in milk yield worth 30*s.* for each ton fed. Where *high* quality hay is made, the financial return will obviously be greater, as it can be used for maintenance and a *substantial* part of the production ration.

Lucerne, a high-yielding and nutritious forage, is a very suitable subject for barn drying, and at least one farmer using a batch drier (loose for the early cut and baled later) consistently gets lucerne mixture hay with 17–18 per cent protein content. This is carefully rationed and provides a major part of his herd production requirements, effecting savings of between 4*d.* and 5*d.* a gallon on purchased concentrates. Many other farmers claim savings of £10 a cow by feeding average barn-dried hay over the winter season; such savings more than offset the cost of the drier in two years. Improved s.n.f. figures for high yielders and increased liveweight gains for fattening cattle and sheep are also reported, together with improvement in milking qualities of suckling ewes. Experiments feeding hay to bullocks at Drayton are reported as showing the barn-dried product to be worth £4 a ton more in actual feeding value than field-made hay—a good margin, even allowing 30*s.* a ton for depreciation of plant!

Good hay at the touch of a switch

Good colour, leaf ratio and "nose" are always present in well-made barn-dried hay. But don't expect barn drying to *increase* the feed value of the herbage conserved! Losses are minimized by reducing the field wilting period and by completing drying under cover with forced ventilation. Even under good conditions, barn drying will ensure more and better hay than swath-drying methods, as has been shown by the N.I.A.E. and the Grassland Research Institute.

Fall in feeding value during haymaking

Haymaking method	Digestible dry matter		Digestible protein	
	Wet year *per cent*	Dry year *per cent*	Wet year *per cent*	Dry year *per cent*
Barn-dried	5·5	1·6	0·6	0·4
Hut racks (tripods)	6·9	1·6	0·8	0·3
Swath-dried	13·1	4·4	1·8	2·2

Barn drying and silage-making can be complementary—the operations fitting in well with reasonable management. Barn drying does, however, offer certain advantages over silage-making, a pertinent criticism of which is the labour involved in the cut-and-carry feeding system. Self-feeding is one alternative, of course, but even with the best methods of unrestricted access, it is not easy to get a daily dry-matter intake of more than 20–25 lb in the form of silage or to provide sufficient for a large herd—at around 100 lb a head a day.

As it is becoming economically expedient to make more use of grass products in the *production* ration, there would appear to be every advantage in the greater use of barn-dried hay for the winter feeding of ruminant stock. This fact is recognized in Holland and West Germany, where thousands (yes, *thousands*) of barn hay driers have been installed, as compared with only a few hundred in Britain.

Challenge to British Growers

W. L. HINTON, B.A.

HIGHER yields and better quality horticultural produce since the war have not been matched by advances in the field of marketing. In many ways, the pattern and methods of horticultural marketing in Britain are little changed since its beginning in the railway age during the heyday of Empire trading. Such developments as there have been fall short of fulfilling the needs of modern conditions at home, let alone putting us in readiness to meet the situation created by the European Common Market.

The two basic requirements for better marketing are improved standardization of grades and inspection of produce, and more consumer research, including advertising. The first is needed to promote quality; the second to stimulate consumption.

Grading of produce to the standard of the Ministry's "Recommended" grades for fruit and vegetables is by no means general practice in this country, yet this standard is necessary if British growers are to offer buyers a service equivalent to that provided by their competitors. Most members of the Common Market already pack and grade their fruit and vegetables for export to the standards established by the Economic Commission for Europe. The produce is subject to inspection, and sub-standard produce is rejected. That we have at present no export trade for our own fruit and vegetables

may account for the sluggish development in the standardization of produce in the United Kingdom; but there is yet time. The other basic need is the stimulation of consumption of fruit and vegetables in Britain. We actually eat less fresh fruit today than we did before the war, whilst vegetable consumption runs no higher than pre-war. By contrast, in all or most other countries of Europe, more fruit and vegetables are being eaten.

It is a fact that, as incomes rise, more is spent on luxury foods, including fruit and vegetables. A real appreciation of this principle should be the keystone of any modern policy for the marketing of fruit and vegetables. Yet in this country too little research has been done on this issue and very little application. Continental countries are far ahead of us here. Marketing research is most advanced in Western Germany where, in an economy similar to our own, consumption of fruit has risen by 50 per cent since before the war. The Horticultural Marketing Council is, it is true, planning research of this kind.

Coupled with the demand for quality produce is the demand for service—the type and size of pack, its attractiveness or convenience, and, in the case of vegetables, washing and other treatments which save time in preparing food. The right pack often determines the profitability of the product. Pre-packing of anything less than quality produce is doomed to failure. We must establish so much confidence in our prepacks that retailers will have no cause to unwrap produce in order to prove to the housewife that the produce is sound.

All these developments will be even more essential if we join the Common Market. The rising standard of our own produce would make us better able to meet increased competition if this should come, whilst there are also many products, e.g., dessert fruit and certain vegetables like cauliflower and Brussels sprouts, for which we could create a profitable export market in Europe. British growers, with their capacity for large-scale organization, are well placed to exploit this, provided the necessary consumer research is put in hand. Growers and growers' organizations must co-operate closely to achieve better marketing through a more positive attitude. A comprehensive scheme for unifying these interests would greatly strengthen our selling power. If British growers are to maintain their position in the domestic market and develop an export trade, better marketing of better produce must be the positive aim of all concerned with the business.

Correction

Weather Reports and Plant Diseases (L. P. Smith, January issue, p. 565). Line 11 should read:

"1. *Smith Periods* (available March 1st to May 31st)"

Chemical Control of Wild Oats in Cereals

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Wild oats in cereals used to be controlled mainly by cultural operations, but with the development of the selective herbicides di-allate and barban, effective control by chemical means is now possible.

WRITING about wild oats in this Journal four years ago (**64**, 502-5), I stated that there were no selective herbicides, effective in cereals, for the control of this odious weed and that the main weapon was the use of various cultural operations. Since then two herbicides have been developed, both of which are capable of drastically reducing an infestation of wild oats in a cereal crop. It is remarkable that a chemical can kill one type of cereal and not another, and as might be expected the use of both of the new herbicides demands caution. Their method of use has been carefully worked out, and failure to follow the manufacturers instructions may lead to disappointing results.

The two herbicides are used in very different ways. One is applied to the soil before the crop is sown, the other is sprayed on to the seedling wild oats in the crop. The soil-acting chemical is 2,3-dichloroallyl diisopropylthiol carbamate, given the short common name of di-allate, and it is the active ingredient in "Avadex" sold by Boots Pure Drug Co. Ltd. The foliage-applied chemical is 4-chloro 2-butynyl N-(3-chloro-phenyl)carbamate, given the coined common name of barban, and sold as "Carbyne" by Fisons' Pest Control Ltd.

Di-allate

This herbicide has been tested on a wide range of crops and, given another season's investigations, it may well be recommended for use in sugar beet, peas, field beans, potatoes and kale. At the moment, however, it is firmly recommended only before sowing barley. The dose suggested by the manufacturers is 1¼–1½ lb per acre.

The important factor in the use of di-allate is its incorporation into the soil. It must be mixed into the soil on the day of spraying and it must be mixed evenly through the top inch or so of soil. This is obviously possible only with a soil of good tilth. Lumpy or cloddy seedbeds, wet sticky soils, or brashy soils where stones on the surface would collect much of the spray, are not suitable when using di-allate. Over-fine and fluffy tilths are also undesirable because they are liable to "cap" and this affects the action of the chemical. Given suitable soil conditions, the next step is to use the right implement. A spring-tine harrow or spike harrow is satisfactory provided the lateral distance between the tines is not greater than four inches. The tines should be set to work to a depth of four inches to ensure adequate movement of the soil between the tines. Implements with tines set further apart than four inches, or implements which "crab" so that tines follow one another through

the soil making the effective lateral width more than four inches, are unsuitable. They will lead to banding of the chemical in the soil and, in consequence, to poor wild-oat control and possibly to crop damage. The rotavator, set to 3 or 4 inches, can also be used and discs have been successful, but they require careful setting and matching of the gangs and should only be used in the absence of a better implement.

Harrowing should preferably be carried out at right angles to the eventual drilling of the barley. Drilling should be delayed for two days after spraying, but if weather conditions change so that drilling is delayed longer than this, there should still be no decline in the control of wild oats. Normal drilling and normal seed rates should be used; the seed rate should not fall below 1 cwt per acre.

The emergence of the crop is sometimes a little retarded and occasionally it is thinned slightly, but recovery is normal and crop yields are usually considerably enhanced through the control of wild oats. The kill of wild oats is substantial, often 90 per cent or more. Those which survive grow into normal plants.

Di-allate is made up for sale to farmers as an emulsifiable concentrate. It is important with the present formulation to make sure that it is properly mixed before beginning to spray and that the spray liquid remains agitated during spraying. The normal volume rate recommended by the manufacturers is 20 gallons per acre. Some low-volume spraying machines with hydraulic agitation do not have pumps large enough to ensure adequate agitation when working near the maximum spray output. In such cases it may be desirable to reduce the volume rate.

Barley sown on treated land should not be undersown. Normal applications may be made of MCPA, and other weed-killers for the control of broad-leaved weeds.

Barban

In addition to field beans and peas, barban is recommended by the manufacturers for use on spring or winter wheat and certain varieties of barley, but not Proctor. The important factors with barban are catching the wild oats at the correct stage and using it only in a good crop. The dose to use is 5 oz per acre, applied when the majority of wild oats are at the most susceptible stage, that is from the one- to the two-and-a-half-leaf stages.

Determining the right time to spray can be difficult, as wild oats do not germinate all together. Generally the majority germinate in a period of one or two weeks, and the spray should be timed to catch this main flush of wild oats when the majority are at their most susceptible stage. This is likely to be during a period of ten days or a fortnight between mid-March and early May. Spraying after this will lead to inferior wild oat control, but worthwhile increases in crop yield may nevertheless be obtained. The second important factor cannot be over-stressed. The satisfactory control of wild oats depends upon a good crop smothering out the many wild oats which may often be checked and suppressed, but not killed, by the spray. All measures should be taken to ensure a first-rate crop: disappointment will result if barban is used on a poor crop.

Crops sprayed with barban may be undersown three days or more after spraying. MCPA and other weed-killers for the control of broad-leaved

weeds may be applied in the normal way three days or more after applying barban. MCPA, etc., should not be mixed with barban.

The spraying of winter wheat is bound by the same considerations as spring wheat and barley. The crop should be satisfactory and the wild oats at their most susceptible stage. Spraying should be aimed at the one- to two-and-a-half-leaf stages of the wild oats. This may be any time between November and the following spring according to when the crop was sown, the season and the species of wild oat present. Obviously the weather may preclude spraying at the optimum time and, as with spring crops, spraying later than this may give inferior results, although there is some evidence that stage of growth of the wild oats is not as critical in the winter as in the spring. Spraying in late February to early April involves the risk of severely checking the crop. This check, however, has never proved detrimental to the final yield where wild oats have been controlled. Wild oats which germinate after spraying are usually kept under by a good crop and are unlikely to produce many seeds. Unlike di-allate, barban markedly affects any surviving wild oats, which usually have smaller heads and shorter straw than untreated plants.

Effects of continual use

Trials by the N.A.A.S. in 1960 and 1961 have shown that di-allate brings about a rather better average reduction in the number of wild oat seeds produced in a treated crop than does barban; but under ideal conditions both are capable of a virtually 100 per cent control of wild oats.

The continual use of these herbicides, particularly if coupled with other methods of control, will lead to a major reduction in the infestations of wild oats. In a chemically treated crop there will usually be some surviving wild oats which can shed seed to replenish, in part at least, the stock of seed in the soil. There will, for a number of years, be some seeds dormant in the soil, even though no further seed is allowed on to the land, and a few of these will germinate from year to year. The herbicides are expensive, and their use on the light infestations which will eventually be achieved is possibly unwarrantable. Thus, after a few years, when the wild oats are reduced considerably, spraying may be stopped. This is the point where the farmer must decide whether or not to try to eliminate wild oats altogether by resorting to hand pulling, etc. Under the new Seeds Regulations he will be able to determine whether he is sowing any wild oat seed with his crop. Therefore the most important source of infestation can now be stopped, so that the elimination of wild oats depends upon the farmers own efforts. The alternative is to wait, and spray again when the wild oat population has once more built up to troublesome proportions, as it must surely do if there is no change in the farming systems under which wild oats have in the past become so numerous.

Spring Cereals and Farm Management

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Yield is the most important factor in securing satisfactory gross margins from spring cereals. Variable costs are comparatively low, and any attempt to reduce them at the expense of yield would be false economy. An adequate return on fixed capital investment must also be kept in mind.

THE 1961 harvest flood of barley was marketed without a catastrophic fall in prices. The latest information at the time of writing (December) shows prices improving slightly and there is no great anxiety over the sale of the remainder of the 1961 crop. The future is rather more obscure. The acreage sown to barley, by far the most popular of the spring cereals, has been rising steadily for some years now, and the support price remains well above world prices both for barley and also for maize, which is a direct competitor. If support prices are lowered, then economies in production must follow.

The present popularity of barley with arable farmers arises in part from its suitability for modern mechanized harvesting, a short straw, even ripening and the minimum of losses due to shedding. Another attraction is the capacity of the new varieties for achieving high yields. Proctor barley has become very popular because it provides the opportunity for gaining malting prices for at least part of the crop without sacrificing the benefit of high yields. The small differential between grinding barley at 17*s.* 6*d.* per cwt, as used in the illustration below, and malting barley at 20*s.* per cwt, does not compensate for much loss in yield. Indeed, at these prices, 26¼ cwt per acre of malting barley would offer no greater return than 30 cwt of grinding grain.

Variable costs

Yield, then, is most important in securing a satisfactory return on barley, though most farmers would spend a little more time and trouble in growing and marketing the crop in order to get quality prices for part, at least, of the harvest. A glance at the variable cost structure of barley growing reinforces this point. The variable costs per acre are comparatively low, and any saving in these costs that reduced yields would be false economy. It should be remembered that the gross margin, i.e., total sales less variable costs, must not only provide a satisfactory profit but also cover the costs of the regular labour force, depreciation charges for machinery and plant, rent, and general farm overheads. These latter are regarded for present purposes as fixed costs which exist irrespective of whether barley, wheat, sugar beet or mangolds are being grown. They are, therefore, left out of the calculation.

These costs are derived from fully-mechanized farms, combining their grain and baling their straw, and in most cases, though not all, drying most of the barley on the farm. Storage was extremely variable, some farmers having sufficient bin capacity for the whole of the crop, though this was unusual. Possibilities of economy in many of these variable costs, e.g., items such as fertilizers, fuel, sprays and twine, concern buying policy rather than restrictions in use. Group purchasing, bulk orders and storage allowances can all

Barley production 1961

per acre

Variable costs	£ s.	Returns	£ s.
Seed	2 2	Grain	
Fertilizer	2 18	30 cwt @ 17*s.* 6*d.*	26 5
Spray	6	Subsidy	
Fuel and repairs	1 17	(estimate)	8 15
Overtime labour	8	Straw	
Twine	10	15 cwt @ 4*s.*	3 0
Sacks	5		
Miscellaneous	4		
	8 10		38 0
Gross margin	29 10		

provide useful discounts and important reductions in cost. Seed is rather a separate item, not open to the same savings. It is common practice to purchase new seed at intervals of years according to the individual requirements of the farm, and this proves satisfactory so long as adequate precautions are taken to ensure purity and high germination.

Artificial fertilizers provide the largest separate item of cost amongst the variable charges. Although it is possible to apply excessive quantities, economy, without a firm foundation of knowledge, can be dangerous. Indeed many farmers consider it desirable to apply the same amounts per acre regardless of the place of the barley crop in the rotation. This is in contrast to the older and still current practice of reducing or eliminating the application of fertilizer to a corn crop which follows a root break, particularly after highly-fertilized cash roots such as sugar beet or potatoes. Despite many trials, there is much ground for argument as to which is the true economy, and results can vary from season to season according to the distribution of rain and sunshine within the year.

As regards the application of the fertilizer, it is interesting to see one complete reversal in practice. Some farmers are discarding the combine drill and applying the artificials as a separate operation. They are using a spinner distributor which can cover a large acreage in a very short time, and this leaves them free to drill the grain without interruption whenever the weather and the land are suitable. There is also a saving on the complicated maintenance of the combine drill. This return to an old practice may result in a higher expenditure on artificial fertilizers, but against this can be set the valuable saving of time at this vital period of the year. Timely drilling can do much to ensure full crops on every acre, especially where large acreages are concerned. Time is scarce, and can warrant a premium payment in the form of additional expenditure on fertilizers.

Economy in labour usage

It is worth recalling that there are, in fact, two peak periods for spring cereal growing and not simply one at harvest. The spring rush can be offset to some extent by substituting winter cereals. There could, however, be little anticipatory action of this kind for the 1961 crop because the previous autumn was one of the worst in memory. The spring cultivations were

increased for most spring crops by the absence of frost in the winter and through lack of early ploughing. Even so the gross margin per hour of spring labour came to £9 5*s.* on the average, and it would have been higher in a more normal year. To put it another way, if, in 1961, an additional hour of labour could have been supplied, sufficient ground could have been cultivated and sown to enable an extra £9 5*s.* to be added to a farm's total gross margin from spring cereals. A similar effect can be achieved by speeding up the cultivations and using the same amount of labour for a larger acreage; hence the use of the spinner distributor instead of the combine drill.

Harvest problems, particularly shortage of labour, have been very much eased by combine harvesters and bulk methods of handling the grain, and, on the whole, grain harvesting is now no greater problem than the spring rush. This position is reflected in the gross margin per hour of harvest labour on spring cereals (disregarding for the moment the hours spent baling and gathering the straw). The margin came to £10 1*s.* per hour of labour, and, season with season, can be considered similar to the margin made attainable by an extra hour of labour in the spring. Additional acres will make about equal demand on resources at both ends of the year, calling for a balanced development of economy in labour usage. This attention is most necessary on farms which are concentrating increasingly on cereal production.

For many farms, however, this comparison does not give the whole picture. These farms compress into the limited harvest period not only the combining of the grain but also the baling and loading of the straw. When this urgent use of labour is allowed for in the calculation, the gross margin per hour of harvesting labour falls from the £10 1*s.* given previously to a mere £4 14*s.* An extra hour of labour has only enabled enough land to be harvested as would bring in an addition of £4 14*s.* to the total gross margin. This clearly indicates that in no case should straw harvesting be allowed to interfere with the grain harvest and further, that if an expansion of the cereal acreage was contemplated, the extra hours of labour required could be made available at the expense of the straw. The main limiting factor on spring cereal production must, then, be considered to be the spring labour requirement.

It is worth looking closer at the returns from straw harvesting.

Straw harvesting 1961
per acre

Variable costs	£ *s.*	Returns	£ *s.*
Fuel and repairs	3	Straw	
Overtime labour	4	15 cwts @ 4*s.*	3 0
Twine	10		
Miscellaneous	—		
	17		3 0
Gross margin	2 3		

Although the gross margin per acre comes to £2 3*s.*, the gross margin per hour of labour is extremely low at 13*s.* This suggests that it is only profitable to bale and collect the straw when other calls on the labour force are less urgent. It is not merely a matter of interfering with the grain harvest; straw collection can delay the gathering of other profitable crops, such as potatoes and sugar beet, or the start of the winter ploughing. Some farmers, too, are

debating the profitability of collecting straw for livestock to trample, in order to cart it back to the field at a heavy expenditure of time and fuel. There may be easier ways of maintaining fertility.

Utilization of capital assets

Capital invested in grain-growing equipment needs replacing if corn production is to continue. As mentioned already, farmers expect the gross margin from spring cereals to provide them with, amongst other things, an adequate return on the specialized investment for corn production. If all the farms providing information had been equipped with driers and storage bins, the investment for harvesting and storage equipment alone would have reached a figure of over £29 per acre, or approximately £1 of investment to each £1 of gross margin. Translated into total figures, this represents a capital investment, excluding buildings, of £5,800 for a farm growing 200 acres of grain, and this is an average and not a maximum figure.

Here lies the crux of modern barley production. A heavy capital investment and a comparatively low variable cost per acre combine to encourage a farmer to expand his cereal acreage either by adding to the total farm acreage or by lengthening the existing rotation. To take a simple example, a £2,000 investment in a combine harvester can be used to harvest 150 acres or 200 acres of grain. In the first case this represents an investment of £13⅓ per acre of grain, and in the second, one of only £10 per acre. Since the gross margin per acre would be the same for both instances, the benefit from the increased acreage is obvious, adding to the total gross margin from grain production without making any call for additional investment.

The question of full utilization of capital assets becomes even more important when money has been locked up in drying and storage equipment.* Some farmers have felt that there were more profitable uses for their capital elsewhere on the farm and have relied on excess combine capacity to offset the lack of a drier. The majority have preferred simplicity in harvesting, and some guarantee that a full and fair price can be obtained every year without inexplicable deductions by merchants. Storage for use on the grower's own farm has clear financial advantages in the saving on transport and marketing costs for bought grain. Holding grain for sale simply because the equipment has been purchased is, of course, nonsense. Unless there is firm prospect of a higher gross margin from storage, it is as well to sell and have the money in the bank.

Although this article has been written in terms of barley production, the same general principles and costs apply with modifications for other spring cereals. Choice between them will depend partly on yield and price—and comparative yields vary from farm to farm—and partly on questions of husbandry. Wheat, for example, guarantees improved returns from storage but is not quite so straightforward to harvest as barley. Oats have perhaps been neglected in recent years and in some areas could well replace part of the barley. Barley, however, will continue to be the most important spring cereal because of its qualities for mechanized grain growing.

*For further information on capital investment in grain production see *The Mechanisation of the Corn Harvest*. M. MATHIESON. University of Leeds.

Nature and Man

REPORTS of Government departments sometimes make rather dull reading; furthermore, the Nature Conservancy has often come under fire as an expensive and unnecessary luxury in these difficult times. All the same I think it would be good for the snipers to read the Nature Conservancy's report* and brood upon it.

For one thing, it is a very widely ranging document. It reports upon the Conservancy's staff and their work, upon the acquisition of new nature reserves and the management of old ones; it reports upon its liaison with other interests in the land use of Britain and upon the activities it has undertaken, at home and abroad, to educate public opinion about nature conservation; finally it reports upon the scientific work which it has undertaken or sponsored. It is a tale of wide achievement for a department which only came into being in the late 1940s.

Any agriculturist who reads this report with attention cannot fail to note at how many points the Conservancy's activities touch upon his interests. Sometimes, indeed, his reaction may be "What on earth has this to do with conservation? We can manage this very well ourselves."

Perhaps one or two examples from the report may be worth examining in this light. First of all, let us consider the work that is being carried out on the island of Rhum, one of the more mountainous of the Inner Hebrides. When this island came into the hands of the Conservancy in 1957, it was typical of much wet moorland country along the west coast of Scotland, in that it was badly overgrazed. The first thing the Conservancy did was to remove the sheep and cattle completely. Then they instituted a system of culling the red deer herd and, to measure the effect of this new regime, they have kept a continuous check, by sampling, on the composition of the vegetation. Furthermore, the erection of fences, first on a small scale, now on a larger one, is showing what kind of climax vegetation (including trees) the island can produce if it is relieved from the constant pressure of overgrazing.

A subsidiary result of the tests which are now going forward on Rhum is the production of almost as much meat from the deer culling as the previous tenant and owner produced from sheep, cattle and deer combined.

The main result so far has shown that the vegetation will recover if grazing pressure is lifted and that, during this nursing of the land back to health, a good incidental income can be made from venison. The possibility of afforesting some areas is also coming to the fore, so that on the whole a more varied habitat will be established which will yield more produce than it has done for many years. This would apply to much country in the West Highlands and it would seem that this "airy-fairy scientific nonsense" of the Conservancy was actually likely to put a lot of land into a higher category of productivity—as hard-headed a result as any farmer could desire.

A second example from the report of work important to agriculture which the Conservancy is doing concerns toxic chemicals. This is a controversial

**Report of the Nature Conservancy* for the year ended 30 September 1961. H.M.S.O. 8*s.* 6*d.*

subject; it is also a difficult one to pin down in discussion because new chemicals are being invented continuously and the simple testing of each one by large-scale field trials involves hazards to wild life because of the unpredictable side effects.

It is clear that to abandon any use whatever of chemical treatments would be cutting off our nose to spite our face; equally clearly it would be inviting trouble to broadcast substances which produced some highly specific and substantial advantage without considering their effect upon the general economy of the land. A middle way must be found, and it is not difficult to forecast that some sprays and treatments will be withheld, others restricted to certain uses and seasons, while a few may be safe enough to free them from any reservations.

There is reasonable agreement about the short-term and long-term safeguards and investigations which need doing to define this middle way, but the initiative in designing a programme of research to this end must belong to a single body*. The Conservancy's new unit at Huntingdon, under the leadership of Dr. Norman Moore, will have care of this task, and every thinking person will wish it well. No farmer would wish permanently to distort the balance of natural things which is as much a part of his stock-in-trade as it is of the forester, gardener or conservationist.

Finally, a word about the list of nature reserves, which occupies twelve pages of this report. It is easy to criticize the apparent sterilization of so much land from the point of view of food production, but we should remember the important reasons for the existence of these reserves. The case of Rhum, already mentioned, shows that there may be practical advantages in the not too distant future for such a policy. Again, it may be noted that much of the land concerned is marginal and would add little, if anything, to production under other forms of management.

But these are not the real reasons for the establishment of nature reserves. These are two: in the first place, the reserving of some "wilderness areas" in a world which is becoming more and more dominated by utilitarianism is good for our souls. In the second place, these reserves act as outdoor laboratories in which we can gain knowledge about the functioning of animal and plant communities. Like all fundamental knowledge, it is desirable for its own sake without considering the practical advantages which may fructify at different intervals of time from this knowledge.

The Nature Conservancy is, perhaps, connected in most people's minds with reserves and, therefore, with "restriction". A study of this report will show how much there is about their policies which is positive and constructive.

H. N. SOUTHERN

* The Advisory Committee on Poisonous Substances in Agriculture and Food Storage investigate the possible effects of a chemical on wild life before they clear it for safe use.—*Editor.*

Water and the Agricultural Interest

G. W. FORD

Ministry of Agriculture, Fisheries and Food

Mr. Ford, now Regional Controller of the South-western Region, was a Government Assessor on the Committee to review the Salmon and Freshwater Fisheries Acts and on the Sub-Committee on the Growing Demand for Water of the Central Advisory Water Committee. The reports of both these Committees deal with aspects of the water problem.

CIVILIZATION cannot be sustained without agriculture, which, in turn, cannot be sustained without an adequate supply of water. The crucial importance of water in the community is therefore self-evident. Fortunately (taking one year with another) the United Kingdom receives in total an annual rainfall that is sufficient to meet the needs of everyone. This last statement, however, requires some qualification. It is estimated that about 375 million tons of water falls on England and Wales each year, but at the same time about 45 per cent of this is lost before it reaches any usable source of supply. The balance available to the community has been, especially in recent times, the subject of increasing demands. Domestic consumption has been going up both because of the increase in population and because of the greater amount consumed per head. The requirements of industry have been increasing, and lastly agriculture has been demanding more, particularly for irrigation. The use of water for irrigation can have important effects on the local supply: firstly, because almost none of the water used returns to the catchment from which it was taken; secondly, because irrigation tends to be practised when the catchment area can least spare the water.

While possibly no *red warning* has yet been generally received, there have in recent years been a number of *amber warnings* indicating that concerted action needs to be taken to preserve, control and develop water resources to ensure that all legitimate demands can be met. For example, in 1959, although the summer was remarkably dry, the year as a whole was not exceptionally so, since there had been ten drier summers during this century. Nevertheless, in 1959 nearly 10 million persons in England and Wales had been affected by drought orders or restrictions on their water supply. These conditions were particularly difficult in many rural areas, where farmers were put to much inconvenience and trouble. Other indications that demand is exceeding supply include the drying up of streams, either altogether or for a substantial part of every year.

One of the difficulties is that the areas on the map showing peak demands for water do not coincide with the areas where water supplies or potential supplies are greatest. Inevitably, this means that even with a rationalized system of distribution, water for some has to be transported a considerable distance and adds greatly to the cost of supply. The costs to the community can be very much greater if the exploitation and development of water resources are allowed to take place haphazardly.

A further contributory difficulty, which limits the utilization of water supplies, is its *quality*. Sources of supply, especially rivers and streams, have

Sprinklers irrigating potatoes.

Blackberries strung on the wire over red currants being irrigated by sprinklers mounted on 5 ft stand-pipes.

Photo: *North Western Electricity Board*

Loading bales into a three-bay storage drier.

Photo: *South Eastern Electricity Board*

Single-bay batch bale drier.

Barn ... pp. 582-7)

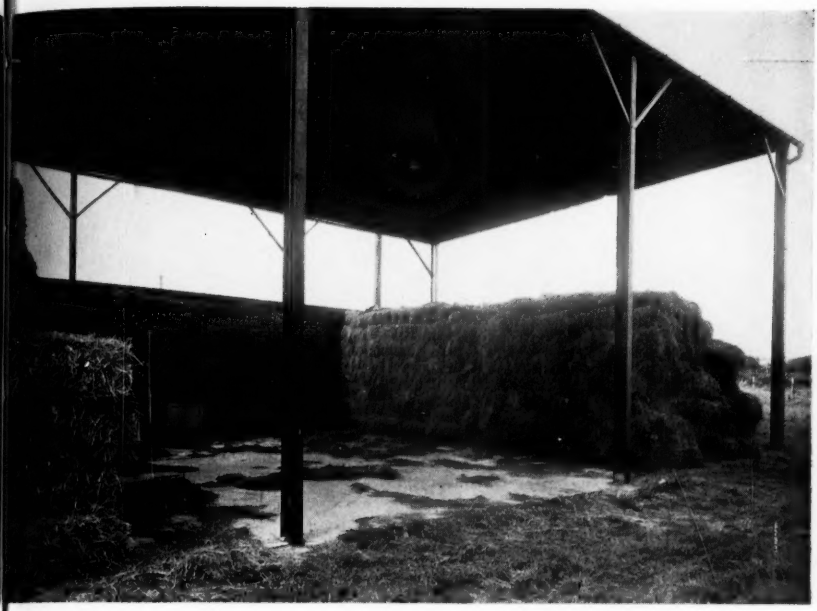

Photo: *East Midlands Electricity Board*

A tunnel of bales being dried in a multi-tunnel installation.

Photo: *South Western Electricity Board*

"High/Low" batch drier.

A Home-Grown Timber House (Article on pp. 602-4)

Photo: *Forestry Commissi*

A Forestry Commission bungalow built from home-grown timber. The carcassing and exter cladding are of Sitka spruce.

Heavy Pig Improvements (Article on pp. 605-8)

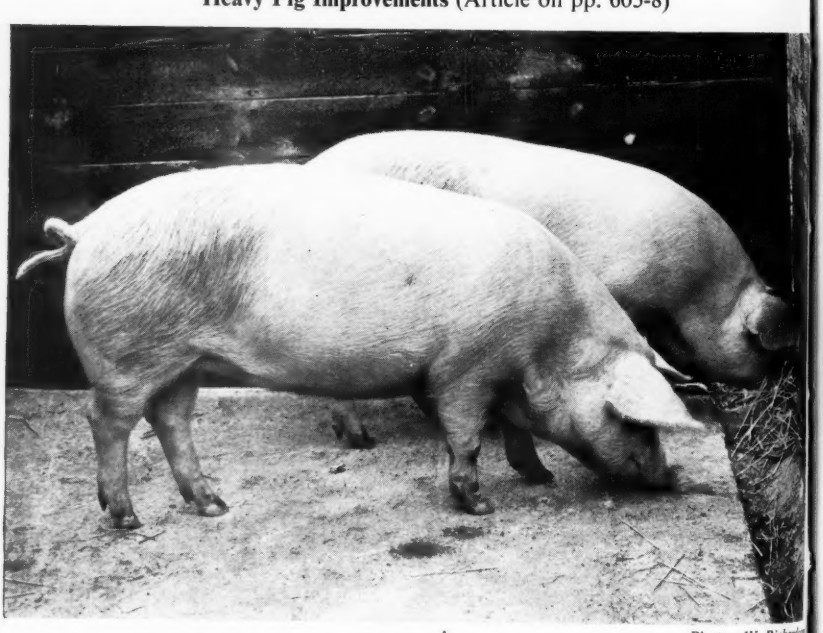

Photo: *W. Richard*

Elite lines heavy pigs at Thanestead Farm. Live weight 260 lb: Conversion 3·60: Age 180 da

in the past been polluted by industrial waste, sewage, etc. The most recent investigation into these questions was by the Armer Committee[1] whose report paved the way for the Rivers (Prevention of Pollution) Act, 1961, which will give River Boards and Catchment Boards further powers of control over the pollution of rivers and streams.

Government investigations

In 1955 the Central Advisory Water Committee (a statutory committee appointed by the Minister of Housing and Local Government under the Water Act, 1945) set up a sub-committee to consider the growing demand for water and the means by which it might be met. The Sub-Committee has made three reports.[2]

In the first report, the Demand Sub-Committee recommended that as a means of improving the statistical information available on water consumption and resources, a start should be made on the preparation of hydrological surveys in areas where the expected surplus of supply over demand was lowest. In accordance with this recommendation, the Ministry of Housing and Local Government has published a number of hydrological surveys[3] of particular river basins in the last two years, and further surveys are in hand.

A similar study was started in 1958 by the Welsh Advisory Water Committee, and its *Report on the Water Resources of Wales* (Cmnd. 1231) was published in April, 1961. Aspects of this matter were also considered by the Committee to review the Salmon and Freshwater Fisheries Acts, and a chapter of its report[4] is devoted to the effect of taking water from rivers and streams.

Finally, on the consumption side and of special interest to agriculture, the report of the Irrigation Study Group[5] is about to be published.

The problem is complex on both the supply and demand sides. Moreover, the problem differs in various parts of the country. No single action, technical or administrative, will secure that supply equates demand. One of the prerequisites is a much greater knowledge of the hydrological situation and of the estimated situations in, say, ten or twenty years' time. For example, on the supply side it is necessary to know for each catchment area what quantities of water (including their differing qualities) both above and below ground are available, and what quantities within the area could be made available by the construction of river-regulating reservoirs or of conventional impounding reservoirs.* On the demand side, estimates need to be made of the current and future requirements of domestic consumers, industry and agriculture; such estimates need to take account of both quantity and quality; water for cooling purposes does not have to be of a high quality, but for some processes (e.g., the brewing industry or watercress production) special attention has to be paid to quality.

*A regulating reservoir is one which is designed for the purpose of regulating the discharge of the river to provide more reliably for direct abstractions at points lower down. Such a reservoir discharges only to the river below the dam.

A conventional impounding reservoir is one from which the supply is taken by means of an aqueduct, and only discharges "compensation" water and overflow water into the river.

Both types of reservoir can have some effect upon flood peaks in the river immediately downstream.

When the *balance sheet* is drawn up, if the demand in the catchment area(s) at any point of time exceeds supply, the conservation programme for the development of water resources will have to be implemented. The first step no doubt will give a high yield in return for the capital invested, but in accordance with the law of diminishing returns, successive steps will become relatively more and more expensive until the point is reached when it may be more economic to seek supplies further afield. Those concerned with agriculture will have to bear in mind the effect of new or proposed works on the level of the water table in the areas involved, the drainage consequences, and the supply of water for irrigation and for the watering of livestock.

Water for irrigation

The second report of the Demand Sub-Committee recommended, as an interim measure (i.e., until the introduction of a comprehensive conservation measure), that abstractions for irrigation from surface water sources should be subject to control. They did not go into great detail as to the form the control should take, except that it should be operated by River Boards whose decisions could be the subject of appeals determined by the Minister. These questions were discussed in greater detail in their 3rd Report.

On the technical side, the report on Irrigation in Great Britain deals with almost every aspect of irrigation. The report concludes that in many parts of Britain the shortage of rain in the six summer months leads to considerable reductions in yields of some crops and large variations in yield from year to year. When the water shortage is made good by irrigation, average yields are increased and the year-to-year variation in yield is lessened. Broadly, for optimum growth, in the area south east of a line from Hull to Torquay there is a need for irrigation in five years out of ten: this need increases in the area of the Thames estuary to about nine years in every ten. Farmers are becoming increasingly aware of the advantage of overhead irrigation and are applying it not merely to market garden produce but to fruit, potatoes, sugar beet, grass and other crops. Costs of equipment and of operation vary considerably, according to the equipment used, the source of the water (whether from borehole, farm reservoir, public water supply or nearby stream) and the distance that the water has to be carried. But much information still has to be ascertained if irrigation is to be used to the best advantage, and the above-mentioned report points to a number of matters on which further research is desirable.

The future

In the light of present circumstances, therefore, the Demand Sub-Committee has made some important recommendations to the Minister of Housing and Local Government on the administration of water resources in England and Wales. These include a proposal that new authorities (the name suggested for them is "river authorities") should be established to take over the existing land drainage flood control, fisheries and pollution-control functions of River Boards (including those of the Thames and Lee Conservancies) and to exercise positive and far-reaching powers in respect of water conservation. The areas of the new authorities would not necessarily be the same as those of River Boards: the Sub-Committee recommended

consideration of the desirability of amalgamating a number of existing areas of River Boards.

The report advocates that the river authority should be charged with the duty to conserve and ensure the best use of the water resources of its area. The authority would need to collect and collate the hydrological information referred to earlier, and would be in overall control (subject to appeals to the Minister of Housing and Local Government) of the use of both ground and surface water. The river authority would be empowered to construct and operate river-regulating and other kinds of reservoirs and to recharge underground aquifers* where appropriate. These proposals could have important consequences for the farming community, and this is dealt with below in greater detail.

Impact of the proposed controls on farming

The Sub-Committee feels that only by measures on the lines recommended above can the largest possible amount of water be made available for all purposes in the most suitable and economical way—a position somewhat different from today, where in an increasing number of places farmers have no assurance that their demands can be met and many streams or boreholes dry up just when water is required.

It is proposed that the permission required from the Minister of Housing and Local Government before a borehole can be sunk in some areas should be necessary for all areas, and that the permission should be given (subject to an appeal to the Minister) by the river authority.

The use of surface water (e.g., from rivers and streams) should be controlled and subject to a licence (in respect of which conditions might be imposed) granted by the river authority. The licences would be subject to periodic review, and the decision of the river authority could be appealed against to the Minister. In operating these controls, the river authority would in respect of each river or stream have regard to the minimum acceptable discharge. This minimum discharge (also subject to appeal)†, would be prescribed by the river authority.

An exemption important for farmers in respect of the abstraction of surface water is suggested. The report recommends that abstraction for domestic purposes should be exempted from control. In this connection the phrase "domestic purposes" is meant to apply to water for ordinary household use, for supplying an ordinary number of cattle and other minor purposes. If this recommendation is accepted, a farmer would in practice only be controlled to any significant extent in respect of his use of water for overhead spray irrigation. Moreover, it is suggested that the river authority, in considering licensing applications and the amounts required, should give priority to established abstractions. Licences would also be issuable to non-riparian applicants, if the river authority consider that the water can be made available and if wayleaves can be obtained from the riparian interests. One of the possible ways in which irrigation control might be achieved would be to impose conditions attached to the licence to abstract,

*To replenish water-bearing strata artificially.

†This is the minimum discharge (or corresponding level) below which the river or stream should not be diminished by abstractions in relation to the needs of all downstream interests.

such as the size of the pumps used, the amount of water that can be taken and when: also, in severe drought conditions it would be possible to forbid any abstraction at all, e.g., where the flow in the stream had dropped to or below the prescribed minimum acceptable discharge.

The recommendations in the report of the Demand Sub-Committee are being considered by the Government. Many of the recommendations could not be implemented except by way of new legislation.

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2. 1st Report (Chairman Ald. R. C. Yates, Dec. 1958), 2nd Report (Chairman Prof. Proudman, March, 1960), 3rd Report (Chairman Prof. Proudman, February, 1962).
3. Great Ouse Basin (June, 1960), Severn River Basin (Nov. 1960), Essex Rivers and Stour (August, 1961), Wear and Tees (Dec. 1961).
4. Cmnd. 1350, Chairman Lord Bledisloe, (May, 1961).
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A Home-Grown Timber House

F. W. HOLDER,

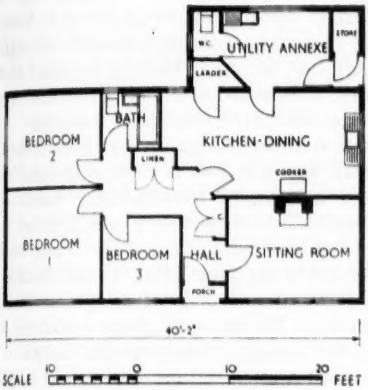
Chief Architect, Agricultural Land Service

In this country home-grown timber is not usually thought of as a building material. To show that it can be used successfully for this purpose, the Forestry Commission has constructed a bungalow almost entirely of timber from its own forests.

THE Forestry Commission has recently completed, on its Research Establishment at Alice Holt, Hampshire, a bungalow constructed almost entirely, above the foundations, of home-grown timber. This building was designed by Mr. S. W. Edwards, the Commission's Chief Land Agent for the Directorate of England, who was also responsible for the supervision of the work. The drawings were produced at the D.S.I.R.'s Forest Products Research Laboratory at Princes Risborough, where the preparation of the roof trusses and other prefabrication was undertaken. The timber used for carcassing was Sitka Spruce, from the forests of Argyllshire, and the joinery was made from New Forest Scots Pine. The largest scantling was 5 inches × 2 inches cross-section, and the maximum length of any member was 9 feet.

Home-grown timber is associated in the public mind with pit-props and similar uses which call for small or medium-sized pieces. The Christmas-tree legend dies hard, and the Commission, in undertaking this experiment, has set out to show the ways in which good use can, in fact, be made of the "thinnings" and small trees in its forests.

The bungalow contains a sitting room, a large kitchen-dining room, two double- and one single-bedrooms, bathroom (with W.C.) and linen cupboard. In addition, there is a small utility room, or wash-house, incorporating a second W.C., fuel store and larder. The larder is approached from the



Layout of bungalow

kitchen-dining room. In area, the individual rooms conform to Ministry of Housing and Local Government recommendations, as set out in the Housing Manuals. The total superficial area of the bungalow is approximately 890 square feet, with an additional 140 square feet in the "utility annexe".

Cooking is by means of a "Rayburn" stove in the kitchen-dining room, which also supplies the hot water, and there is an electric immersion heater in the hot water storage cylinder for summer use or as a supplement to the solid fuel system. The sitting room has an open-hearth fireplace, and power points have been supplied to all bedrooms so that portable electric fires can be used. Heat loss is minimized by the internal chimney stack which serves both the sitting-room fire and the cooker. All plumbing is in copper tube.

Details of construction

Construction is simple, and consists of brick foundation walls upon which prefabricated timber panels are erected. The panels, which form the external walls, are framed in 4 inch × 2 inch Sitka Spruce, covered on the outside with double boarding (spruce) and internally with aluminium foil-backed fibre-board. Internal partitions generally are lined on both sides with fibre-board. An exception is the utility annexe, where the internal finish is vertical tongued-and-grooved V-jointed boarding, with natural wood oiled finish. It is worth noting that the fibre-board used for internal wall and ceiling linings, and also the hardboard facings to the internal flush doors, has been manufactured in Britain, out of timber from North Wales forests.

The external walls have been designed to carry the weight of the timber roof, so that, if desired, the internal partitions can be moved independently of the main structure. The roof trusses are of timber, spaced at 2 foot centres, and are "built-up" of thin sections, nailed together. The use of nails as an alternative to bolts in this type of construction has been advocated for many years by the U.S.A. Forest Products Research Department as a simple and effective method, which does not require the same degree of skill and precision as bolted construction. Roof coverings are red-coloured concrete "Double Roman" tiles on boarding for the bungalow, and felt to the flat roof over the utility annexe.

The use of tiles as a covering, instead of wood shingles, is a valid criticism, but in this instance the only suitable home-grown material is oak, and this happened to be unobtainable at the time it was needed. The Forestry Commission was also in some doubt as to the possible behaviour of oak shingles, and as cedar could not be considered because it is an imported timber, the

well-tried and maintenance-free tile covering was preferred. The use of waterproof felt under-tiles is regarded in some quarters as being a better weather repellent than boarding, but in this case it was probably thought that boarding would give added rigidity to the roof, bearing in mind that it is supported on the external walls only. Boarded floors on joists are used throughout, except in the utility annexe, where the floor is of concrete.

All the timber used in the construction of this bungalow has been treated with preservative. The method adopted was a diffusion process in which a highly soluble boron salt (disodium octaborate tetrahydrate, marketed under the name of "Timbor") was used. The preservative was applied by spray before the timber was stacked for seasoning. This process has been used widely in New Zealand, but so far not to any great extent in this country. The external cladding, in addition, received one coat of oil preservative. The insulating boards used in the internal linings were given a coating of flame-retardant paint before leaving the factory. Work on the bungalow, which is now occupied by a Commission Forester and his family, was begun in the spring of 1961 and completed in autumn of the same year. The builder was Mr. M. Ventham, of West Liss, Hants, who was responsible for the foundations, drainage and site works; for assembling the timber components on the site and erecting them; and for internal services and decorations.

Comfort and appearance

Although it has not yet been tested through a winter, the degree of insulation provided is such that interior conditions should be very comfortable during the coldest weather. Some heat may tend to be lost through shrinkage of the floorboards, but, once again, timber flooring was essential to the experiment and any limitations on this score must be accepted. The insulating boards used for internal wall linings are of the softer, "spongier" type, and either have not been damped before fixing or are beginning to swell through moisture in the atmosphere. The condition is aggravated by initial movement and drying out in the structural timbers prior to the building "settling down", and cracks are apparent at the joints of the insulating board. Later on, it may be necessary to fix wooden cover strips over all joints to hide the cracks. It might have been an advantage to have used a denser type of board in the first instance.

Aesthetically, the combination of natural wood walls, red-tiled roof and white painted windows is most pleasing, and the interior colour schemes are well-considered. The oak (home-grown) entrance door in natural wood finish strikes a rather discordant note; its small glass panes contrasting unhappily with the windows with their large areas of glass. Fortunately, the door is tucked back into a small lobby, so the contrast is not too obvious to the passer-by.

Apart from these minor criticisms, the experiment appears most successful, and the total cost of the bungalow, at about £2,500, compares very favourably with that of more "traditional" dwellings of the same standards of accommodation.

Heavy Pig Improvements

J. A. P. FRIEDLANDER
T. Walls and Sons, Ltd.

WORK has been carried out during the last thirty years in the United Kingdom to improve the production of Wiltshire bacon pigs. Relatively little work has, however, been done to secure improvements in other forms of pig production, and my own Company did not enter the sphere of pig research with heavy pigs until some six years ago. Our work has been aimed, in the first instance, at discovering the weight at which lean meat could be obtained in the most economic manner, and thereafter at securing improvements through nutrition and genetics in the economics of production and lean content of pigs at this weight.

Dissection to define lean content

At the time of decontrol in 1954, we had no preconceived notions as to the methods of production or the weight ranges at which pigs could provide lean meat economically. Nor had we, or any other section of the trade, any real knowledge at that time of the make-up of the carcass, and the variation in lean content obtained with different diets at various weights. Our initial task, therefore, was to identify a method of defining lean content that was accurate and practical, for assessing lean within a range of plus or minus 1 per cent on lean in the carcass for all pigs placed on test work, so as to provide data on lean meat content that could be linked to production costs.

We found that the only reliable method by which this could be achieved was through detailed knife dissection of the whole carcass. The broad base of this dissection was to split the pig into its normal cuts of leg, middle and shoulder, at the 6th and 7th lumbar vertebrae and 6th and 7th rib, and then remove all "non-usable meat" such as bone, rind, gristle, offal, etc., leaving "usable meat" which is dissected into lean and fat throughout each joint of the total carcass. All dissection work has been checked by chemical analysis; in fact, it took over a year to build up sufficient data in 1955–56 to define standards of dissection that were accurate. This dissection originally took eight hours, even when using a team of skilled butchers, but this has subsequently been reduced to four hours by building up data to provide a formula for the lean content of lean within semi-lean, and finally to two hours by securing a formula for dissecting one side of each pig instead of the whole carcass.

Many other short cuts on carcass measurements have been recorded along with dissection, but these have not given sufficiently accurate correlations of lean to be of any benefit, and we are still left with carcass dissection as being the only means of defining lean accurately. Over the past six years we have dissected a total of 12,000 pigs.

Nutritional requirements for 260 lb carcass

Reverting to 1955–56, we were able, after defining lean accurately through dissection, to begin large-scale research to provide data on the economics of

production at one-score weight ranges from 140 lb to 300 lb live weight, followed by carcass dissection, so that we could define where lean suitable for modern products could be obtained most economically. And it was from this work that we discovered that this would be achieved at 260 lb live weight. Having made the decision to go forward on this weight, we were able to extend our research into the basic nutritional requirements of pigs at 260 lb live weight, and on the genetic selection of pigs that could produce lean most economically at this weight.

With nutrition, the main fundamental work has been carried out between 1956 and 1961 at Colworth House (Unilever Food Research Department), and the main emphasis here has been the determination of the correct amino acid, mineral and vitamin requirements for heavy pig production. Besides this work at Colworth, applied work has been carried out at our own farm at Thanestead, near High Wycombe, and at other independent outside centres such as Nottingham University, Harper Adams Agricultural College, and others. In each case this work has combined the economics of production with the lean content being obtained through carcass dissection, and we therefore have had an accurate yardstick of how different feed treatments affect the lean content of the carcass.

Although there are immense fields to enter for improving nutritional knowledge, we do believe we have gained sufficient knowledge over the past four years to demonstrate that with practical commercial rations, efficient results can be obtained. As an example, the results of two of the independent centres are given on p. 607, and it will be seen that on 288 pigs a conversion of 3·6 in 184 days can be achieved, and that such figures are not outside the normal commercial farmer's reach, even on present-day knowledge.

The genetical side

It is clear that very real genetical improvement can be secured if one selects the best possible strains for economic production and lean, separately, and we have now started our own Progeny Testing Station in order to select genetic potential for efficient weaner production, efficient fattener production, and maximum lean content. Each of these factors is marked separately, and the best boars on each requirement will be used to make inroads into the economic production of lean meat.

At Thanestead we have been carrying out genetic selection, originally based on the results of 164 litters, for these three same factors, and we are now at the stage where breeding stock on elite lines are becoming available. With these elite lines, for efficient weaner production, Essex/Wessex Saddlebacks have produced weaners at the lowest cost, and this has been achieved at an average cost of £3 11*s.* per weaner, as against an overall average cost for pure-bred pigs of £4 8*s.* The most efficient lines selected for conversion and growth have been Large Whites, which have converted at 3·6 in 180 days, as against the pure-bred average of 4·3 in 230 days. On lean content, the best strains here have been Landrace, which have produced 55 per cent lean in Usable Meat and an eye muscle size of $6\frac{15}{16}$ sq. inches, as against an average of 50 per cent lean in Usable Meat and eye muscle size of 5 sq. inches.

We are cyclic crossing these three lines to provide lean meat more economically from heavy pigs, and further results will be published on this in due course. It is, however, of interest that over the original testing on 164 litters,

Conversion: Results from two independent centres

	NOTTINGHAM UNIVERSITY		HARPER ADAMS Skim milk			
Trial	4	6	*Treatment*	A	B	C	D
No. of pigs	80	78	No. of pigs	30	20	40	40
Overall conversion	3·69	3·73	Overall conversion	3·45	3·52	3·58	3·66
Age at 260 lb	188 days	188 days	Age at 260 lb	182 days	180 days	183 days	184 days
Rations	(to 150 lb) *per cent*	(to 150 lb) *per cent*	*Rations*	(to 140 lb) *per cent*	(to 140 lb) *per cent*	(to 140 lb) *per cent*	(to 140 lb) *per cent*
Barley	69½	69½	Barley	30	43½	37½	37½
Rolled wheat			Rolled wheat	33½	43½	41	41
Offals	10	10	Offals				
Flaked maize	10	10	Flaked maize	20		20	20
Fish meal	10	10	Fish meal	7½			
Soya			Soya	7½	12		½lb/pig/day
Minerals			Minerals	1	1	1	1
Vitamins A and D	½	½	Vitamins A and D	½	½	½	½
Skim milk			Skim milk		2pt/pig/day	6pt/pig/day	2pt/pig/day
	(150-250 lb) *per cent*	(150-250 lb) *per cent*		(140-260 lb) *per cent*	(140-260 lb) *per cent*	(140-260 lb) *per cent*	(140-260 lb) *per cent*
Barley	82½	80	Barley	44	46	40	40
Rolled wheat			Rolled wheat	44	45	38	38
Offals	10	10	Offals				
Maize meal			Maize meal			20	20
Soya	5	7½	Soya	10	7		½lb/pig/day
Minerals	2	2	Minerals			2	2
Vitamins A and D	½	½	Vitamins A and D	2	2		
Skim milk			Skim milk		2pt/pig/day	6pt/pig/day	2pt/pig/day

cross breeding in itself provided very substantial advantages in reducing costs of production, and the figures below show that this amounted to £1 4*s*. 7*d*. per pig, and cross breeding is in fact followed and applied by 90 per cent of heavy pig producers today.

Improvement by cross breeds over pure breeds

RESULT OF 164 LITTERS

No. born	No. weaned	Weaner weight	Cost per lb weaner	Conversion rate	Age (weeks)	Total cost of pig	Weight of lean meat lb oz	Cost per lb lean meat	Per cent lean on live weight
½	¾	3¾ lb	4·34*d*.	0·33	2¾	£1.4.7	1 13	5·1*d*.	0·69

Future developments

The work that has been mentioned indicates that a start has been made to secure improvements in the economic production of lean meat, whereby the costs of production on the farm are linked with the lean content of the carcass being obtained. All this work has been carried out against the background knowledge and belief that we have to attempt to make pigs fit into our agricultural economy, and thereby make use of the assets that we hold in this country of farm size, farm capitalization, and availability of some by-products for feeding.

However, in order to step up the contribution in nutritional and genetic research so that much greater improvements can be made on the economics of production, we have recently made a very considerable capital investment for research to be carried out on a much larger scale in the future. This work will now be carried out at five of our own testing centres, and we shall be able to provide pig producers with the practical tools of feed supplements and proven-tested stock which they can utilize, so that practical improvements can be achieved on the farm as quickly as possible.

★ NEXT MONTH ★

Some articles of outstanding interest

TOTAL SOLIDS IN MILK *by A. S. Foot*

WORK STUDY IN HORTICULTURE *by A. P. Mitchell*

HYBRID VIGOUR IN PIGS *by W. M. R. Evans*

HERRINGBONE PARLOUR IN 1962 *by E. C. Vestergaard*

Farm Secretaries

A New Career for Girls

ELIZABETH HESS, N.D.H.
Principal, Studley College, Warwickshire

A NEW career is opening up for trained girls—that of Farm Secretary. Last September, Studley College started a one-year course for Farm Secretaries. Only girls who have already had a good general education of grammar school standard are accepted, and special emphasis is laid on English and mathematics as a requirement for entry.

Five subjects at "O" level is the minimum requirement, but the majority of girls accepted for the course have more than the minimum, and some have "A" level subjects as well. It is clear, therefore, that the course is by no means a soft option for the girl who doesn't want to make the effort to qualify for the two-year Dairy Farming Diploma Course. In addition, all entrants should have completed a full year of practical farm work before coming up to College, but in fact some have done very much more than the one year, and some have also undertaken a farm institute or agricultural college course. Thus girls are well prepared for the rather strenuous course of intensive study. Their day begins at 8.30 a.m. with the first lecture and continues until five o'clock on most days. Part of each week is spent at the Redditch College of Further Education where, in modern buildings equipped with up-to-date equipment, they study commercial subjects and English. For the rest of their time they lead a varied life at Studley Agricultural College, studying Agriculture, Farm Management, Book Keeping, Agricultural Economics, plus a course in Economics in co-operation with Birmingham University, designed to show them some of the bigger issues of our national and international life.

About five hours each week are spent on the subject of Farm Management, including the analysis and discussion of various records, e.g., pedigree records, national milk and pig records. Calculations concerning estimates of feedingstuffs and fertilizers in stock and budgeting for future requirements are also included.

After a preliminary period of essential book keeping, they pass on to cost accounting and exercises in connection with various aspects of business efficiency. Valuations, P.A.Y.E., insurance all find their place in the course, and time is also spent in studying farm building plans and Ordnance Survey maps. A short course in first aid, training on telephone switchboard, and regular farm walks are an integral part of the course, and help the potential Farm Secretary to become versatile, eager and efficient.

It has been the practice for some time at Studley to require all first-year students to attend a weekly journals class with the Principal, and all Farm Secretaries therefore spend one hour each week discussing items of interest in the agricultural journals and the national daily and weekly press. This ensures that they read the journals, for they never know when they may be called upon to produce an abstract or a report from the journal which has been allocated to them.

They also study current affairs in conjunction with the Extra-mural Department of Birmingham University, and this course encourages clear thinking and speaking and a critical approach to what they read and hear.

It can be seen, therefore, that the intention is not merely to turn out competent shorthand typists, but to train these girls to make themselves indispensable on the farm and invaluable in village life generally.

Sixteen students are on the present course, some of whom have already received promises of employment. It is confidently expected that every one of them will be able to secure a good post at the completion of their course next July, and some of them will probably set up a small secretarial relief service for a number of small farmers.

It is a requirement of the College that every one of these Farm Secretaries should find vacation employment in an office during their training, so that they should be conversant with office methods and routine when they leave the College.

The establishment of the course was undertaken by the Governors of Studley College, upon the suggestion of the Agricultural Colleges Committee under Sir Keith Murray two years ago. The secret of its initial success is partly due to the considerable help which was given by many interested people in the preparation of the syllabus, and to the careful selection of students admitted.

THE MINISTRY'S PUBLICATIONS

SINCE the list published in the January, 1962, issue of *Agriculture* (p. 564), the following publications have been issued.

LEAFLETS

Up to six single copies of Advisory leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 6d.).

ADVISORY LEAFLETS

No. 28. Apple Blossom Weevil (Revised)

No. 42. Codling Moth (Revised)

No. 227. Mangolds and Fodder Beet (New)

No. 375. Cloche Cultivation (Revised)

No. 441. Nitrogenous Fertilizers for Farm Crops (Revised)

No. 504. Seed Potato Sprouting (New)

No. 507. Soft Fruit in the Garden (New)

OTHER PUBLICATIONS

N.A.A.S. Quarterly Review Vol. XIII, No. 54. Winter 1961. 2*s.* (by post 2*s.* 4*d.*)

The Remuneration of Milk Distributors in the United Kingdom (New). 4*s.* (by post 4*s.* 4*d.*)

Report of the Committee appointed in 1959 under the Chairmanship of Sir Guy Thorold.

Farming Cameo: Series 2

46. Leek, Staffordshire

P. HALL, N.D.A.
District Advisory Officer

THE town of Leek itself (some 20,000 inhabitants) is situated 630 feet above sea-level at the foot of the Pennines. For years a centre for silk spinning and dyeing, thanks to the River Churnet, the man-made fibres, nylon, rayon and terylene, are now the predominant manufactures and give employment to girls from the country districts. The men are employed in light engineering, paper mills and butter blending plants, and west of Leek the population looks to the Potteries. The rest of the area is primarily agricultural, many of the smallholdings being occupied by quarry and county council workers and used as homes rather than as sources of income.

The district is an upland area on the southern slopes of the Pennines, rising from 600 to 1,600 feet, bounded north and east by Cheshire and Derbyshire and to the south by the Leek-Ashbourne road. There is no lack of natural beauty. From The Cloud, a high point at the north end of Biddulph Moor, the Cheshire plain can be seen extending to the Mersey Estuary. The valleys of the Dane and the Dove and the scattered villages are tourist attractions. Overlooking Leek, The Roaches, Hen Cloud and Morridge, hold back the heather and peat grouse moors. Between Leek and Macclesfield is Rudyard Lake, originally constructed by the railway companies to feed the Midland Canal system. At Meerbrook, Tittesworth Reservoir supplies water to the Potteries.

Geologically the area is fairly straightforward. The greater portion lies on Millstone grit, three-quarters of which is above 1,000 feet, with points up to 1,500 feet. East of the Manifold Valley to the Derbyshire boundary is an area of Carboniferous limestone, a high proportion of it between 750 and 1,000 feet. Heights of 1,200 feet occur only on the flat or rounded hilltops. At the southern end of the Pennines and running south-east to north-west at 600–700 feet from Cheddleton to Rudyard is an area of Triassic formation.

Yearly rainfall over much of the Millstone grit averages 50 inches. Monthly temperatures range from 36°F in February to 57°F in July. The soils are usually heavy clays, with infertile sands on the higher slopes. Peat overlies shales in hollows and valleys, typical of which is the Goldsitch syncline. There is an abundance of surface water, and drainage is naturally poor. On the limestone the climate is not so severe and rainfall averages 40 inches a year. The soils are thin but well drained and more fertile than those derived from the Millstone grit. There are few surface streams and no drainage problem, and the grassland tends to burn quickly in dry weather.

Most of the district is engaged in dairying, especially winter milk production. The average size of holding is approximately 65 acres. The grazing period is short (May–September) so it is necessary to get high productive stocking rates and also to buy in concentrates. At one time rearing played a more important part in farm income, but in recent years rearing stock has

been replaced by dairy cows and many more flying herds have been established. This change has coincided with the influx of young men and the retirement of the older farmers. It has also brought many problems, the greatest being shortage of capital to provide extra stock and, where necessary, extra buildings. Fortunately the banks serving the area are agriculturally minded and co-operation between farmer, bank manager and adviser has been developed. It is unlikely that a young man putting forward a sound plan will fail through lack of finance.

High use of concentrates and the turnover in cows on the flying herd system poses problems of rationing, calving indices, replacement of low-yielding cows, level of profitable production and now milk quality. These are formidable, requiring good cowmanship and records. The young men are enthusiastic about keeping records, and regular meetings plus an organized record-keeping system, have enabled many farmers to reduce costs by up to 70 per cent. The better use of fertilizers, better grazing and cutting management and heavier stocking have increased production. Ley farming is not practised on a large scale because the heavy, wet soils quickly poach. Improvement can come by reseeding to permanent mixtures of timothy and meadow fescue after a pioneer crop, or by direct reseeding if carried out satisfactorily. The new sward usually receives 3 tons ground limestone and 10 cwt basic slag every three years, with 4 cwt high phosphate complete fertilizer every year. One cow per 1½ acres is the aim of most young men.

Little machinery is available or necessary. Contractors are few. A simple grassland system is, therefore, essential. Many farmers consider that the most economic machine on the small intensive dairy farm is the mill-and-mixer. Up to £5 per ton, they say, can be saved on 20-cow herds. Housing the dairy cow has resisted changes in the Leek district, but parlour and self-feed silage layouts have been constructed. The substantial traditional stone-built cowsheds have been gutted internally to provide warm bedded lying areas.

Whilst cattle account for 85 per cent of the stock numbers (with slightly more young stock to cows on farms in the limestone area), sheep have increased recently. There are few pure breeding flocks, because sheep are a subsidiary enterprise to the dairy herd and act mainly as scavengers. Old, broken-mouthed ewes are preferred, usually costing less than £5 each. Swaledale, Derbyshire Gritstone and Scotch Blackface ewes are crossed with the Suffolk, ewes and lambs being sold fat from June onwards. Lambing percentages rarely fall below 125. The ewes often return more at sale than the original purchase price. The wool clip usually covers all feed costs. As altitude and acreage of rough grazing increase, the proportion of farm income from sheep also rises. There is little poultry but interest is being shown in turkeys for breeding and fattening. Pigs are few because not many buildings are suitable for efficient pig keeping.

On the Trias, farming is rather more mixed. The average size of farms is 100 acres. The dairy herd is dominant, and up to 70 cows on 140 acres is not uncommon. As elsewhere in the district, Friesians and Ayrshires have replaced the Shorthorn. Despite the importance of the cow, more arable cropping is being practised. The main cereal crop is barley, usually Rika or Herta, but some Capelle wheat is grown and a small acreage of spring oats. The rootbreak comprises kale for the dairy herd and, as a cash crop, Dr. Macintosh and Majestic potatoes.

Your Fixed Equipment

Cattle Grids

G. B. YOUARD
Agricultural Land Service

It was in 1950 that cattle grids were mentioned in the Gracious Speech. This caused amusement and curiosity. "What", it was asked, "are cattle grids?" Newspapers attempted, not always successfully, to give the answer; some people were fearful, believing that the bars ran in the direction of the road. But the Highway (Provision of Cattle Grids) Bill went through, and five years later, when the Ministry surveyed all the grids on the highways of England and Wales, they had increased five-fold: 1950 was the coming-out season of the grid.

This is not an article about highway grids; it is about private grids. But during the survey much was recorded about animal behaviour which is true of both. There were some nice stories: the cow and the horse who, when being taken to pasture, regularly preferred to cross a grid rather than use the by-pass gate held open for them; and the Swaledale ewe who would drop herself on her belly, with legs between the bars, and then "swim" over-arm (or over-leg) across the grid. But lest it be thought that these stories show that grids are of doubtful value, let it be emphasized that those farming near the grids were loud in their praises.

Incentive plays a big part in animal escape and it must be acknowledged that if the urge is strong enough—be it maternal, sexual, from fear or for food—individual animals will cross grids however well they are designed, and generally without hurting themselves. But then this is true of most fences and gates; occasional escapes are bound to happen. Many farmers interviewed during the survey stressed the point that it was nearly always the same animals that escaped, and there was some evidence that as the older sheep, who had known a road when it was gated, left a flock, the number of escapes descreased. Habit, then, is probably a factor to be reckoned with.

While it is evident that determined animals of all kinds can cross grids, there is no need to make it easier for them to do so. This simple piece of fixed equipment can be a tremendous boon; it can also lose much of its usefulness if certain things—seemingly little things—are wrong in the design.

One cannot be dogmatic about length; so much depends on the incentive to escape and the type of stock kept. For example, where contented cattle have plenty to eat and nothing more tempting can be seen on the other side of the grid, 7 feet may be successful; on the other hand, such short grids usually fail with hill sheep, and it is best to make the pit not less than 8 feet 6 inches long.

In the early days it was thought that a deep pit—3 feet or so—was needed, and that it should hold water as an added deterrent. Some years ago the Ministry carried out tests to find out the minimum depth needed to deter stock. Although it was difficult to get conclusive results, it seemed that the critical point was reached when the depth was reduced to less than 8½ inches

below the bars. Stock then started to escape. It is wise to allow a margin and make a pit about 10 inches deep below the bars. There is no evidence that water is an added deterrent; it merely provides a watery grave for small animals.

The narrower the bars, and the wider the spaces between them, the more open a grid appears to an animal and the greater the discouragement to attempt a crossing. Tubes are more discouraging than flat-topped bars, and the best size to use is one with a nominal outside diameter of 2 inches. The gap between bars should not be less than 5 inches, and with flat-topped bars 6 inches is better. With these spacings, there is very little jar to wheeled traffic, including bicycles.

Apart from the obvious fact that a hoof should not be able to span a gap, there are two other advantages in 5 inches. First, a man can stand on the floor of the pit, with his legs between the bars, to remove leaves and rubbish which, it has been noticed, encourage animals to try their luck. So, too, do weeds growing on an earth floor. Second, a gap of 5 inches allows freedom of movement should an animal get its legs down. For these two reasons it is doubtful whether bars need be made removable.

It is essential that the tops of the walls should not be left flat. Sheep, in particular, can negotiate a surprisingly narrow path, and so can ponies. The walls must be rounded off where they meet the bars.

A fence must be erected along each side of the grid, right over the faces of the pit walls, or stock will manage to get round the terminal posts of the fences that meet the grid on each side. They can perform remarkable feats of agility at this point.

Tubes may be good deterrents but they are poor load-bearers, and should not be expected to do much more than provide a medium for the wheels to roll on. For single line traffic—and fortunately no private grid need take two lines—it is the supporting walls that should mainly carry the load, and not the bars; their number and arrangement will therefore depend on the wheel tracks of the vehicles which the grid is to carry. The aim should be to arrange the intermediate walls so that they support the bars as nearly as possible under the wheels of the heavy vehicles expected. By restricting the distance between the side fences to a width that will just comfortably take the heaviest vehicle, its wheels are forced to run in one path only; then the supporting walls can be arranged in that path.

In 1960 the Ministry of Transport carried out a test to find for this Department the permissible gross weight of vehicle to be allowed on a tubular grid, with tubes of 2 inches outside diameter, when each set of wheels ran directly over two supports spaced 1 foot apart between centres. It was found that the permissible gross weight was 6 tons per axle. Now 6 tons per axle covers all the vehicles likely to visit a farm, including the big oil tankers on four axles weighing 24 tons. What more need be asked of a private grid?

At the Farmers' Club

How I Would Plan British Farming

MR. COLIN CLARK, Director of the Agricultural Economics Research Institute, Oxford, ventured into the realms of science fiction in introducing his talk to the Farmers' Club on 10th January. By postulating a threatened world disaster that fortunately never materialized, he gave a plausible reason for describing how he and a team of New Zealand scientists would plan the total reorganization of British farming in 1965, with only 150,000 men to cope with 30·9 million acres of cultivated land plus 17·4 of rough grazing.

There would be more farmers and fewer wage earners than at present, achieving high incomes without subsidy, though Britain, as a full member of the Common Market, would still face many of the present-day problems of marketing, in direct competition with European producers. This drastic replanning would leave many farmers and workers in the cold. "In my view", said Mr. Clark, "they would be entitled to generous compensation" and he outlined a scheme of direct payments, based on average earnings from farming over the last three years, scaled to allow six years' full payment for men over 45 formerly earning less than £1,000 a year, with lower rates for younger men and more prosperous ex-farmers. There should be new rural industries to employ people displaced from the land.

Dairying would be confined to regions enjoying warmth and steady rainfall; cereals would be grown in most of the eastern counties, and the rest of the country would produce beef cattle and sheep. Cereals producers could be expected to do moderately well in the Common Market, he said —"the well-equipped low-cost producer in Britain can probably challenge any rival . . . not only in Europe but in the world, allowing for transport costs".

The primary objective of the British dairy farmer should be to produce only the milk needed for liquid consumption (some 1,700 million gallons a year). This could be helped out by small supplies from Europe in periods of scarcity. Mr. Clark advocated production on a quota basis, spread evenly over the year, with payment at rates substantially above manufacturing price to cover necessary winter feeding costs, using hay and silage rather than concentrates. Milk in excess of this quota would receive only manufacturing price.

"It does not seem sensible", declared Mr. Clark, "for Britain to be planning to produce dried milk, butter and cheese". Under the Common Market, dairying is likely to develop substantially in parts of Europe which are favoured climatically, like the Po Valley in Italy, and while the Market's external tariff remains "not altogether unreasonably high" New Zealand butter and cheese will be able to jump it.

As for meat production, inadequate though our methods of pasture management may be, they are better than those in Europe, and our costs are lower. Thus in the Common Market our hopes should be highest for

beef, mutton and lamb production, and Mr. Clark foresaw that Britain would probably become an exporter of beef to Europe.

The aim would be to raise the output of our grassland. Dutch scientists have shown that a dairy cow, grazing *ad lib.*, eats 33 lb (dry weight) of grass daily, and needs 5½ tons (dry weight) annually if fed entirely on pasture, hay and silage. Dr. Davies, of Hurley, believes that the best leys in Britain yield these amounts, but annual averages are only about 2·7 tons for leys, 2¼ tons for permanent grass and only about 0·9 tons for rough grazings. In practice, livestock consume only about 35 per cent of the ley's output and corresponding figures for permanent grass and rough grazings are 30 per cent and 5 per cent respectively. Good management could raise these proportions to nearly 80 per cent.

For meat production from grass, Dr. Davies' objectives for annual liveweight gain per acre range from 1,000 lb on the best pastures to 600 lb on most permanent grass and 300 lb on what are now described (and neglected) as rough grazings. Present averages vary from 300 lb on leys down to 50 lb on permanent grass—"a figure as low as some of the worst recorded for dry and totally undeveloped pastures in Africa and Australia". On good grazing land in Ireland and Devon, more than 500 lb liveweight gain has been claimed. Much depends on grazing management, and Mr. Clark quoted American work in which ordinary rotational grazing yielded a gain of 413 lb liveweight in 168 days, strip grazing produced 580 lb and zero grazing with unwilted grass 700 lb.

The basic question is how to make the grass grow, remembering that in the Common Market fertilizers will be cheaper. "Nitrogen fertilizers can greatly increase the income from grassland, but only in very skilled hands." Research in eastern Holland, where the summers are hotter and drier than ours, has shown that returns can be profitable up to at least 160 lb N per acre per year. The unfertilized pastures yielded 1 ton of dry matter per acre annually, or 2½ tons when water application matched evaporation. The maximum obtained from using full doses of N fertilizer were 2¼ tons without irrigation and 7 tons with irrigation.

"It is clear", said Mr. Clark, "that a great deal more fertilizer is necessary". Dr. Davies has recommended applying 300 lb lime per acre every year, even to rough grazings, plus 30 lb each of P_2O_5 and K_2O (40 lb P_2O_5 on phosphate deficient rough grazings) as compared with the present average of 10 lb of each on permanent grass. "With nitrogen", he added, "Dr. Davies is a whole-hogger, and would like to go up to 400 lb, which some would say is too much of a good thing", but experiments at Hurley have shown no signs of diminishing returns from N applications up to 210 lb per acre, each lb N yielding approximately 30 times its weight of additional grass, dry weight.

SYLVIA LAVERTON

Agricultural Chemicals Approval Scheme

THE second List of Approved Products issued under the Agricultural Chemicals Approval Scheme was published on the 1st February. It contains details of additional products approved since the 1961 edition was published. Approved products carry a distinguishing mark—reproduced here. Farmers and growers are advised, in their own interest, to look for this mark.

The Approval Scheme deals with the efficiency of proprietary agricultural chemicals. The Approval mark means that the Agricultural Departments in the United Kingdom are satisfied that the claims made on the labels of approved products, relating to insect pests, diseases or weed control, the dosage rates and the crops on which products can be used without damage, are based on sound experimental and practical experience. Labels also include details of the precautions necessary to ensure the safe use of the chemical, the name of its active ingredient, the proprietary name and of the Company marketing the product.

Copies of the 1962 List can be obtained free on application to the Ministry of Agriculture, Fisheries and Food (Publications), Ruskin Avenue, Kew, Richmond, Surrey, or from any of the Ministry's Regional or Divisional Offices.

The following additional products have been approved under the Agricultural Chemicals Approval Scheme since the 1962 List of Approved Products went to press:

INSECTICIDES

GAMMA-BHC (LINDANE) WETTABLE POWDERS
Agrocide 26 DP—Plant Protection Ltd.

ENDOSULFAN (a chlorinated hydrocarbon for the control of big bud mite on black currants)

LIQUID FORMULATIONS
Thiodan Emulsifiable Concentrate—Boots Pure Drug Co. Ltd.

"RHOTHANE" WETTABLE POWDERS
"Rhothane" Wettable—Pan Britannica Industries Ltd.

HERBICIDES

DALAPON *Sodium Salt Formulations*
Boots Dalapon—Boots Pure Drug Co. Ltd.

DICHLORPROP *Liquid Formulations*
Polyspray—Pan Britannica Industries Ltd.
Shepp DP—Shell Chemical
Stantex 24-DP—S.D.C. Pesticides Ltd.

MCPA *Potassium and Sodium Salt Formulations*
Neals MCPA—G. & S. G. Neal Ltd.

MECOPROP (CMPP) *Potassium and Sodium Salt Formulations*
Neals CMPP—G. & S. G. Neal Ltd.

SODIUM CHLORATE WITH MONURON *Granular Formulations*
"PP" Chlorea Granules—Plant Protection Ltd.

In Brief

ROW WIDTHS FOR PEAS

At the present time about 5,000 acres of peas are grown in South Lancashire for canning or freezing, and approximately 700 acres for the open market. To meet a developing demand, farmers had been growing the crop for many years, and when canning and freezing contracts were first offered in the area farmers were already highly skilled in growing the crop in wide rows. Row widths of 24–26 inches facilitate harvesting by hand, and also allow cultivations to be carried out to control weeds.

Mechanical harvesting, and the introduction of successful herbicides, has enabled many farmers to start growing on narrower rows, and peas are now grown at either 7, 12, 18 or 26 inches. There is considerable interest among growers in this development and, in view of this, it was decided that the N.A.A.S. should put down some observation studies in 1961.

Because of the difficulties of cultivating and harvesting small plots, it became necessary to rely upon the results of two observations, using one-acre areas per treatment. Three row widths of 6½, 13 and 26 inches were used, on a sandy clay loam, and substantial increases in the yield of Lincoln peas were obtained with the narrower row width. At the same time there was a clear indication that considerable difficulty, and perhaps complete failure, could result when using narrow rows where weeds were not fully controlled by chemical spraying.

The second observation study confirmed that narrow rows give increased yields, at least with short-strawed varieties, although differences were not so great. It was also found that peas grown on the flat on wider rows slighly out-yielded those that were ridged.

It seems therefore that, provided land is free draining and clean, narrow row widths are preferable. Where, however, there is a serious weed problem, particularly grasses, in a climate which is especially favourable to weed growth, there should be some caution before changing to narrower rows; and this also applies where, as a result of exceptional fertility, and especially with longer-strawed varieties, very rank growth is anticipated.

G. J. Clarke

COLORADO BEETLE IN 1961

Twenty-three live Colorado beetles, including one larva, were reported in 1961, as compared with 46 in 1960 and 20 and 22 in 1958 and 1959 respectively. No breeding colony has been found since 1952.

Our experience during the last fifteen years has led us to expect Colorado beetles to be discovered in January and February, but in 1961 the first beetle was not reported until 5th May. The second beetle was intercepted on 12th May, and the remaining discoveries were spread over the period up to 26th October, when the last one was found. The single larva was reported in July.

Ten beetles were found on imported vegetables or fruit: 5, including one larva, were associated with Belgian potatoes, 2 with Dutch lettuce, 2 with Spanish onions and 1 with Italian cherries. The remaining 13 beetles were found on miscellaneous cargoes from Portugal under circumstances that suggested that whilst in dock the ships had been invaded by flying beetles, or possibly, that beetles had alighted upon cargoes on the way to the ports or awaiting shipment.

The Ministry is indebted to all the people who have co-operated in reporting Colorado beetles during the year, and asks for continued support in the campaign against the pest.

H. W. Janson

FIRE BLIGHT OF PEARS, 1961

Fire blight was first confirmed in England in 1958, when it was found in 14 pear orchards in Kent and one in Worcestershire. By the end of 1960 it was known to occur on pear, hawthorn and related ornamentals in London and its suburbs and in Southend-on-Sea, Essex, and on ornamental shrubs in a few nurseries in Surrey. It had also been detected in pear orchards in the Wisbech area of Cambridgeshire and in additional orchards in Kent. During this period the efforts of growers and the Ministry's Plant Health Inspectors to eradicate the disease appeared to have been successful in Worcestershire and nearly successful in one area in Kent. Generally speaking, it seemed that the spread of fire blight had been checked in the other fruit areas, in Southend and in the Surrey nurseries; in Greater London its distribution and incidence were not known with any certainty.

The 1961 campaign, which was directed mainly to the fruit districts and to Southend, produced encouraging results in these areas. As can be seen from the table below, work in 1960 and 1961 had reduced fire blight to a very low level in all areas except the Cooling Peninsula.

Pear trees grubbed because of fire blight in orchard areas

	1958	1959	1960	1961
Kent				
South of Maidstone	1560	5	25	1
Cooling Peninsula	522	203	920	221
West of Gillingham	478	904	568	7
East of Gillingham	0	0	453	13
Cambs (Wisbech)	0	0	431	7
Worcs	35	0	0	0
Surrey nurseries (ornamentals)	0	0	16	0

Very few affected plants could be found in Southend at the end of the year but in Greater London fresh outbreaks, which were discovered in the west, north-west, east and north-east, pointed to the impracticability of eradication there. Fire blight was also found for the first time in the Essex fruit belt, near Witham (the earliest infection traced in this outbreak occurred about July); 77 pears, 10 hawthorn and a cotoneaster were involved. In N.W. Hampshire two cotoneasters were affected in a garden near the Surrey border.

R. A. Lelliott

FREE VACCINATION AGAINST CONTAGIOUS ABORTION

A Free Calf Vaccination Service with Strain 19 vaccine is to begin on 1st May, 1962. On that date the existing Calfhood Vaccination Scheme will come to an end.

The aim is to build up a national herd highly protected against outbreaks of abortion by the vaccination of all female animals during a certain period of calfhood. Vaccination at this time will ensure that the great majority will have ceased to react to the blood (agglutination) test by the time of first calving.

Calves must be vaccinated between the 151st and 240th day of life—that is, during the period of 90 days following the date on which an animal reaches the age of five months. It has been found that vaccination, if carried out during this period of calfhood, will in most cases protect against abortion for at least five pregnancies. There is little or no advantage to be gained by re-vaccination.

Calves vaccinated under the official service will be tattooed with a device and date code.

Farmers who wish to use the Free Vaccination Service must present all female calves for vaccination during the time they are eligible for the free service and must not vaccinate any animal (more than 240 days old) except with the agreement of the Ministry. Failure to obtain such agreement may result in withdrawal of the free service.

From the point of view of ultimately establishing the freedom of the national herd from brucellosis, it is of the greatest importance, for technical reasons, to confine vaccination to the relatively narrow age range prescribed. During the first year of the new service, the Ministry will normally agree to the vaccination—at the owner's expense—of calves which would have been eligible under the existing Scheme had it continued to operate. These privately vaccinated animals will not be marked. But when the new Scheme has got fully into its stride, vaccination of animals over 240 days old will not be agreed except in special circumstances, e.g., in a herd where there is a severe outbreak of abortion.

An explanatory leaflet and an application form for the new service will be sent to all farmers with cattle before the commencing date.

BEAUMONT'S PERIOD

The name of Albert Beaumont is assured of a distinguished place in the annals of British agriculture, for it was he who gave us the "Beaumont Period" of potato blight forecasting. He has just retired (December) after nearly forty years in the Ministry's advisory services for farmers. A Yorkshireman, he took his Degree at Cambridge, and in 1923, at the very beginning of the old advisory service, he went to Seale-Hayne College, in Devon, as the first Advisory Mycologist for Devon and Cornwall. He was there until 1946, when, at the inauguration of the present National Agricultural Advisory Service, he returned to his home county as Regional Plant Pathologist for Yorks and Lancs.

It was at Seale-Hayne, studying the local blight epidemics year after year, and relating the dates of blight outbreak to his own careful meteorological observations, that Beaumont was able to simplify the "Dutch Rules" for blight forecasting, and to propose in their stead the more practical humidity-temperature rule which now bears his name. The teasing out of this rule was a fine piece of work, but what was even more noteworthy than the rule itself was the extreme caution and scientific integrity with which he finally put it forward in his classical paper of 1947, published in the *Transactions of the British Mycological Society*.

Beaumont never claimed too much for his rule. He pointed out, clearly enough, that though it might be fairly easy to record Beaumont periods, the way in which the occurrence of these periods should be interpreted to provide valid forecasts for different parts of the country would need detailed and country-wide investigation. His challenge to enquiry was taken up on a national scale in 1950, with the result that a practical forecasting scheme for England and Wales was worked out and put into successful operation.

But Beaumont's work on potatoes was by no means confined to forecasting. He took a leading part in the war-time potato spraying campaign in Devon and Cornwall, and gave a new direction to all potato spraying trials by his insistence on the need for accurate study of the progress of the disease on the haulm, and of spray retention, as well as the determination of yields. Survey and loss-estimation methods that he suggested or inspired have since been employed throughout this country, and indeed have provided a model for the accurate investigation of potato blight epidemics wherever they may occur in the world. During the war years he was also greatly concerned with potato virus diseases, and he was the technical secretary of the Devon and Cornwall Seed Potato Growers' Association.

Beaumont is the author of two well-known books, *Diseases of Garden Plants* (Collingridge, 1956) and *Diseases of Farm Crops* (Collingridge, 1959), both based on his own long-continued and acute observations, and both characterized by his taste for speaking strictly to the point. Those of us who have had the good fortune to work with Beaumont salute him as a true natural philosopher, light-hearted, merry, and exceptionally shrewd. He has chosen Cornwall for his retirement. Long may he "cultivate his garden", and continue his phenological observations on spring flowers.

E. C. Large

Book Reviews

Hunger: Can it be Averted? Sir E. JOHN RUSSELL and Dr. NORMAN C. WRIGHT. British Association for the Advancement of Science. *5s.*

This booklet gives the optimistic answer; and the strict unemotional coldness of the scientific approach establishes a climate in which the answer becomes acceptable.

The conclusions recorded are those of a group of prominent scientists who were invited, in 1960, by the British Association for the Advancement of Science to discuss the part that science could play in relieving present hunger, and in averting the inevitable agony that would follow if man's proliferation should outrun his powers of food production. Looking forward across forty years—as scientists they would not claim to usurp the duties of later scientists to look again in the light of greater knowledge—they found that the full application of present knowledge would be sufficient to remove fear. But at a cost, for the solutions to the complex problems involved will be neither easy nor cheap, and the group emphasizes the need for early action.

The action foreshadowed is seen as two-phased. First, the rapid short-term contribution that must be expected from those countries now blessed with good agricultural lands. Here are at hand the technological requirements and the social environments for stepping up production by increased investment. The economic difficulties of the transfer of supplies, though real, are not insoluble, given the spread of understanding and the inspiration of justified self-sacrifice.

Valuable though this aid would be, the second phase is the more important, since the main source of the increased food supplies needed to raise present standards of nutrition in the under-developed countries, and to compete with rapid rises in population, must come from these countries themselves. Apart from heavy capital investments and considerable technical assistance, this revolution will demand educational and social advance on a massive scale.

It is expected that, by about the end of two decades of intensive application, the shape of the longer-term world position will become clearer. The stage will be set for each nation to consider its rate of population growth as something potentially under its own social control.

A wide range of subjects is covered in this concise publication—population growth and food requirements, land resources, possibilities of increasing food production, and the associated economic problems. A graphic appendix vividly highlights the major aspects in a series of diagrams and charts.

The key-note of this inquiry is sounded by Professor P. M. S. Blackett's conclusion:

> "We as scientists and technologists have already given ourselves the tools by which hunger could be banished from the world—it is now up to us as citizens of the world to make sure they are used, so as to finish the job."

G.G.

International Code of Nomenclature for Cultivated Plants, 1961. International Bureau of Plant Taxonomy and Nomenclature. *2s. 6d.*

Nobody concerned with the writing or editing of horticultural literature can afford to be without this booklet. Since the last edition in 1958, certain further proposals have been considered by the responsible body, the International Commission for the Nomenclature of Cultivated Plants. Experience of working the code has also proved the difficulties of enforcing certain rules. A new edition was therefore found to be necessary and it is hoped this will remain current for some considerable time.

The main amendments are concerned with the clarification of the rules for new cultivar (variety) names, for the use of botanical names in Latin form, for the naming of hybrids by use of the term "collective epithet" and their registration.

The International Code is now becoming well known and adopted by all the leading authorities in many countries.

Copies may be obtained from the Royal Horticultural Society, Vincent Square, London, S.W.1.

M.M.

Blackcurrant Survey. J. RENDELL. Bristol University. *Unpriced.*

The development of the blackcurrant juice industry in this country has been a major factor in maintaining a relatively stable price level for currants, unknown in pre-war years. It is perhaps fitting, therefore, that one of the pioneer companies responsible for putting blackcurrant juice on the market in a big way should have financed this study into the economics of blackcurrant growing.

Mr. Rendell's comprehensive study covers a total of 271 costs, involving 1,700 acres through the three cropping years of 1957-9. The areas covered include the main blackcurrant districts in the midland, western, southern and eastern counties of England. This survey is being conducted on a six-year term, and although the report under review is therefore only interim, it is nevertheless a most valuable piece of work which deserves careful study by all interested in the cultivation of the crop—established growers and beginners alike.

After a description of the regional sample (covering such items as cropping age, row width, varieties, etc.), the author deals with financial results (returns, costs and margins, replacements, fertilizers, cultivations, sprays, pruning, maintenance and picking costs, etc.). Chapters follow on establishment, cropping age analysis, prices and costs per ton, etc. A series of maps pinpoint yields in the three years, and diagrams show yield variation with popular varieties and frequency distribution of margins and maintenance costs. There is also a comprehensive selection of excellent and easily followed tables and some very interesting general information to complete this noteworthy study by an economist with a practical "down-to-earth" outlook. The appendix on "Organisation of Picking" was done with the co-operation of Mr. H. J. Eaton, of N.A.A.S., who is an authority on work study.

The theme running through the report emphasizes the point that yield and price are the main items governing profitability. An average yield of 1 ton per acre at £135 per ton only produces an investment income of £2 per ton, whereas an average yield of 2 tons per acre, "a not impossible target" (author), raises this over £50 per ton.

I look forward to the final report in three years' time.

B.D.A.T.

Potash Fertilizers: Mining, Refining and Properties. Booklet No. 3. Potash Ltd. 2*s.* 6*d.*

A hundred years ago the only sources of potash available to farmers and growers were farmyard manure and wood ash. But in 1961 the potash salts discovered five years previously in the rock salt mines of central Germany were first mined for sale as a fertilizer. Since then their use has increased enormously, particularly in recent years. United Kingdom consumption totalled 425,000 tons in 1960, more than double the quantity used in 1950.

It is wrong to think of these potash salts as "artificial" manure. They are natural deposits formed 200 million years ago by the slow evaporation of inland seas. This illustrated 28-page booklet explains their nature and tells the fascinating story of how the raw materials are mined and refined for use on the farm. It will interest any farmer who has an enquiring mind, and is clearly a "must" for students.

Today, potash mining is highly mechanized. The latest machine, the Continuous Miner, nibbles away at the rock face, grinding the material as it is removed and ejecting it behind into a shuttle car. In the early days, the raw mineral was ground and sold as "kainit", containing less than 20 per cent K_2O. Improved refining techniques have made greater quantities of concentrated products available, and today virtually all the potash used in British agriculture is of 60 per cent grade. *S.L.*

Sheep Husbandry and Diseases (4th Edition). ALLAN FRASER AND JOHN P. STAMP. Crosby Lockwood. 35*s.*

When in 1957 Dr. Stamp added a section on sheep diseases to the third edition of Dr. Fraser's already well-known book on sheep husbandry, the combination of authorship produced a volume which everyone interested in sheep, and especially the industry in Great Britain, should not only read but also read again. In this new edition, the form and presentation have been repeated, with material and discussion brought up-to-date, so that it is the more firmly established as a valuable and stimulating source of information and ideas on the many different aspects of sheep production and management.

Both authors maintain their individualistic approaches; the two parts are distinct and complementary. Each part has its own index. This method of covering the field may have some weaknesses and the reader may feel deprived thereby of joint authoritative statements or discussion—as for example, on such matters as dense stocking or set stocking as against rotational or creep grazing. Nevertheless, the whole makes a very readable and comprehensive book on the wide scope of the sheep industry and its problems.

After a short review of the world's sheep trade, Dr. Fraser discourses at length on the world's sheep breeds. He then deals with breeding, sexual physiology, mutton, wool, milk production and nutrition before discussing hill and lowland sheep husbandry in two all too short final chapters. But he seems happier, freer, and more provokingly Fraserian when he is dealing with topics within his own special interests and experience than when he is drawing on other authors for his material.

Dr. Stamp's method of describing sheep diseases according to whether they are acute and characterized or not by sudden or early death, or are chronic, debilitating, or with localized symptoms, will be appreciated by farmers, who wish not only to know the causes of diseases in their stock, but also to understand the means of preventing and treating them.

Authors and publishers together are to be congratulated on making available so timely, pleasing and satisfying a work, at such a reasonable price. *J.E.N.*

The Soil. JOHN MACBEAN. Faber and Faber. 30*s*.

The study of soils is an excellent example of applied science. The results are not only interesting in themselves; they explain existing practices and point the way also to technical improvements. We have here a subject of great educational value that can be studied to any level. The author has addressed his book to pupils in Secondary Schools, Farm Schools and Farm Institutes, and others who have some elementary science. His aim has been to make a balanced selection from the vast amount of material available and present it as accurately as possible without getting involved in difficult scientific explanations, while always bringing out the practical applications.

On the whole the selection has been good. The treatment follows conventional lines, with chapters on rock weathering, soil formation, soil constituents, soil water and air relationships, and the botanical principles of plant nutrition. The points are illustrated by clear diagrams, and for those who have the facilities, simple experiments. The final chapters on liming and manuring are perhaps rather detailed for general students, though adequate for those in touch with farming.

As regards balance, a useful addition would have been a few paragraphs showing how soil treatments by cultivations, herbicides and fertilizers are tested in the field; also a few notes on the sources of information from which the matter of this book was derived, and from which it could be supplemented. This could be done by pruning notes on soil minerals, plant constituents, and herbicides.

Unfortunately the book does not show the high standard of proof-reading customary in scientific publications. There are spelling mistakes and several errors in numerical data and chemical formulae. Moreover, artichoke does not contain insulin, nor is a fertilizer "unit" 10 per cent of a ton. A diagram on p. 65 is upside down.

Those still at school or farm institute will need the help of their master to get the best out of this book, but it is not sufficiently advanced for degree students. *H.V.G.*

Bibliography of Farm Buildings Research 1945-58. Buildings for the Processing and Storage of Fodder. Part vi Agricultural Research Council. 4*s*. 6*d*.

In times of change, such as we have had in the last twenty years on British farms, there comes a time when ideas and variations upon them have so multiplied that they become bewildering to the average person. To try to sort the wheat from the chaff is often beyond the capacity of the ordinary mortal, who has not the time or the opportunity to analyse, criticise and assess the value of the ideas. In consequence those ideas which get the most publicity become the height of fashion. Inevitably in these circumstances money is spent on buildings which is afterwards seen to have been wasted.

This latest part of the A.R.C. Bibliography, like its predecessors, assembles in

a concise form the research and experimental work having a bearing on buildings for the processing and storage of fodder. New thinking on the conservation of fodder and its storage and handling, calls not only for new husbandry methods but new buildings also. Barn hay drying is a case in point and this is well covered in the Bibliography.

A careful study of the evidence to which this Bibliography refers will help owners and farmers to avoid mistakes and waste of money in buildings, and this part of the Bibliography can be recommended to them as strongly as the earlier parts.

C.R.

The Mechanisation of the Corn Harvest. Farmers' Report No. 151. MORAG MATHIESON. University of Leeds. 5*s*.

A careful reading of Miss Mathieson's excellent account of an Economic Study based on the records of 101 Yorkshire farmers is a sobering experience for any exponent of high mechanization, because it suggests that high mechanization of the corn harvest had not correspondingly improved the output per man. This caused Miss Mathieson to ask herself why farmers buy machinery. Her answer is that some of them do buy it to save labour, but others buy it because they like machinery or because they like the income tax allowances that go with the purchase of new machinery.

The average repair cost for combine harvesters per year in this survey is quite high. Figures worked out from 70 self-propelled combines gave an average annual repair cost of £25 10*s*., which is a cost of 4*s*. 2*d*. per acre. The average acreage per machine was 123 acres. On a sample of 29 trailed combine the average annual repair cost came out at £27 which gave an average repair cost per acre of 6*s*. 7*d*. The average acreage combined by each machine was 82 acres.

The survey was made in 1959, and at that time 49 out of the 101 farms had a corn drier. Of the driers 29 were of the continuous flow type, nine were ventilated silo type, seven were batch driers and four were platform sack driers. Fourteen of the 49 present owners of driers had switched from other types to continuous flow machines before 1959, and another four put in continuous flow driers for the 1960 harvest. Prior to 1959, eight ventilated silo plants had been superseded by continuous flow driers and the bins were used for storage only in 1959. Two further plants were to be converted to continuous flow in 1960. Reasons for giving up drying by ventilation were stated as lack of capacity for coping with a wet harvest and trouble with pockets of mould grain contaminating the rest of the corn in the silo. Before 1959, three farmers had replaced platform sack driers with continuous flow driers and two more were to be replaced in 1960. A general opinion was that both batch driers and platform sack driers had high labour costs.

H.J.H.

Chemical Control of Insects (2nd edition). T. F. WEST and J. ELIOT HARDY. Chapman and Hall. 50*s*.

The ten years since the first edition of this book have witnessed tremendous developments in insecticides and to attempt to survey the whole field is a herculean task which has involved almost complete rewriting. The book is aimed at "students and workers in different but allied subjects", apparently with an eye on the American market as well as that in this country. It is clearly not intended for farmers or general agricultural advisers, who will find that it lacks a practical approach.

After a few general introductory chapters the book is divided mainly into chemical groups and within these each chemical is discussed separately. Chemical and physical details are followed by a survey of agricultural, medical, veterinary and other uses throughout the world and a brief review of the principal literature mainly in American and British publications.

Unfortunately, despite its great potential value as a work of reference, this book has some defects. No convention is adopted to show which are agreed common names and which are proprietary names. Although the chemicals include some which have only just reached the British market there are several surprising omissions such as fluoroacetamide and the so-called "ovicide" group of acaricides. The index is good but has several spelling errors, the most curious being the references to "alphalpha" pests. The price might have been less if the plates, none of which bears any relevance to the text, had been omitted.

H.C.G.

English Farming Past and Present. LORD ERNLE. (Sixth edition). Heinemann & Cass. 50*s*.

It is now nearly fifty years since the first edition of Lord Ernle's *English Farming Past and Present* appeared, and much has happened to English farming in the meantime. For so long as he was able, Ernle kept the story up to date with new editions of his book but, until this year, none had appeared since that of 1936 edited by Sir Daniel Hall.

The main feature about the present edition is that it contains two new introductions, written by G. E. Fussel and O. R. McGregor. These add some 120 extra pages to the book. Their purpose, however, is not in any way to bring the history of English agriculture up to date. In fact, the text of the book itself remains the same as in Hall's edition. But they discuss in considerable detail some of the weaknesses which are apparent to historians, and they amplify the historiography of the subject which Ernle dealt with much too superficially: "his reading was narrower than that of earlier writers; and he resolutely ignored the research of his contemporaries".

Another weakness of Ernle as an agricultural historian was his partisanship over the land question. Without disputing the right of the historian to treat his theme subjectively, a fair assessment of Ernle's work is that it was so influenced by his social and political convictions that it has retained its reputation as a classic only because these did not seriously distort his vision in the period discussed in Fussel's introduction, and because in Hall's edition "very little of Lord Ernle's original text relating to the nineteenth and twentieth centuries remains".

The text of *English Farming Past and Present* is too well known to need a review; it is to the new Introductions that the reader's attention should be directed. These set out to give weight to those aspects of history which later research shows that Ernle paid too little attention to, they refer to writers whom he ignored, and they bring the histriography of the subject up to date by reference to recent publications, some as recent as 1961. They provide, in fact, stabilizers that will help to prevent the unwary reader from being tossed in a sea of generalizations which might otherwise cause him to lose his direction.

The style of Ernle's agricultural works was of a quality rarely attained by such writing, and many of the admirers of *English Farming Past and Present* would be disappointed if they felt that it was, nevertheless, insufficiently accurate in its details to be depended on. It is reassuring, therefore, to know from Fussel that "a great deal of the research in the last thirty years has largely confirmed him" and that "it will be a long time before this worthy book is superseded". *W.H.L.*

Diseases of the Pig (Fifth Edition). D. J. ANTHONY and E. F. LEWIS BAILLIERE. Tindall and Cox. 35*s*.

This book has come to be regarded as the most authoritative British textbook on pig diseases. The new edition is of the same high quality as its forerunners. A chapter on the diseases of newly-born and young pigs is a welcome addition, while tuberculin testing and the doses of the commoner drugs used in treatment have been rewritten in the form of appendices.

The first five chapters deal thoroughly with the various aspects of husbandry and describe different breeds of pigs, the requirements for specific purposes such as breeding, the pork market, the bacon trade and grading, several systems of housing and management, methods of feeding, dentition, health and restraint.

The remainder of the book is concerned with disease problems, and this section begins with a list, including descriptions, of the diseases which are notifiable under the British Diseases of Animals Acts and Orders.

The impression gained from the subsequent chapters is that the authors have attempted to include as many different conditions as possible, and this has reduced the amount of detailed description which some diseases require. For instance, it would have been useful to include an explanation of the enzyme system involved in the association between zinc and parakeratosis, since many readers will continue to wonder why such a comparatively unknown element should be such a specific prophylactic for this disease.

These slight omissions, however, do not detract from the general value of the book, which can be recommended to both agricultural and veterinary students and indeed to anyone taking up pig farming as a career. The more assiduous student who wishes to increase his knowledge about certain subjects in the text will find plenty of references at the end of each chapter.

A.L.W.

The Small Farmer. MARGARET BRAMLEY. Crosby Lockwood. 15*s*.

Mrs. Bramley discusses the economic circumstances of small farmers (defined as those occupying holdings of less than 100 acres which provide employment for between one and three people), their efficiency compared with that of other farmers, their economic relationship with the large-scale firms which supply feed, machinery, and fertilizers, or buy horticultural produce or broilers, the benefits they can obtain by co-operation, their sources of capital, the impact on them of Government policy, and how an expansion of production could assist the balance of payments and help to relieve poverty in under-developed countries. It is argued that although about one-third of small farmers earn inadequate incomes, yet they have the capacity to make reasonable profits; that they are as efficient as larger farmers, especially because they use land more productively and intensively; that they need a greater share of subsidies, more capital, and an expansion of production.

As an economic assessment, the book is impaired because it is not completely objective. For example, the small farmer's more productive or intensive use of land is argued from the fact that output per acre diminishes with increasing size of farm, although this reflects chiefly a greater dependence on livestock fed with bought concentrates and does not necessarily or generally indicate greater intensity in actual cultivation or stocking. If the test of economic efficiency is power of survival there may be some inconsistency between the proposition (*a*) that small farmers are as efficient as other farmers, and (*b*) that they need more support. The statement that past experience shows that home-produced food is not likely to be more expensive than imports may be thought to require some qualification. The processes by which the small farmers can help under-developed countries are not perhaps explained at sufficient length to be wholly convincing or reliable as a guide to action.

There seems to be an error on page 83 where the maximum possible reductions in any one year under the 1957 Agriculture Act are referred to as "five per cent for any one cereal crop, and three per cent for any one livestock product". The maximum reductions are four per cent in any one year, with the over-riding limitation for livestock products of nine per cent in any three consecutive years.

The book seems to be aimed in the first instance at the general reader; to some extent at small farmers themselves, and at those who influence agricultural policy. Mrs. Bramley writes well, with skill and economy, and so produces an easily-absorbed and interesting story. As descriptive journalism it is very good.

G.S.

Book Received.

Hill Farming Research Organization. Second Report 1958-61. Obtainable from 48 Palmerston Place, Edinburgh 12.

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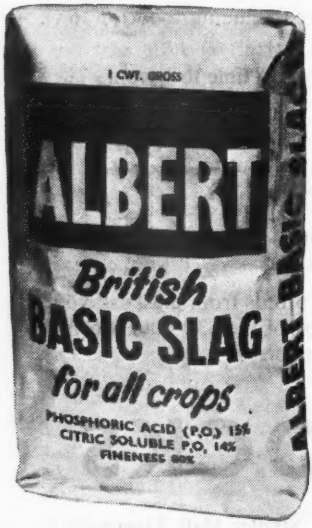

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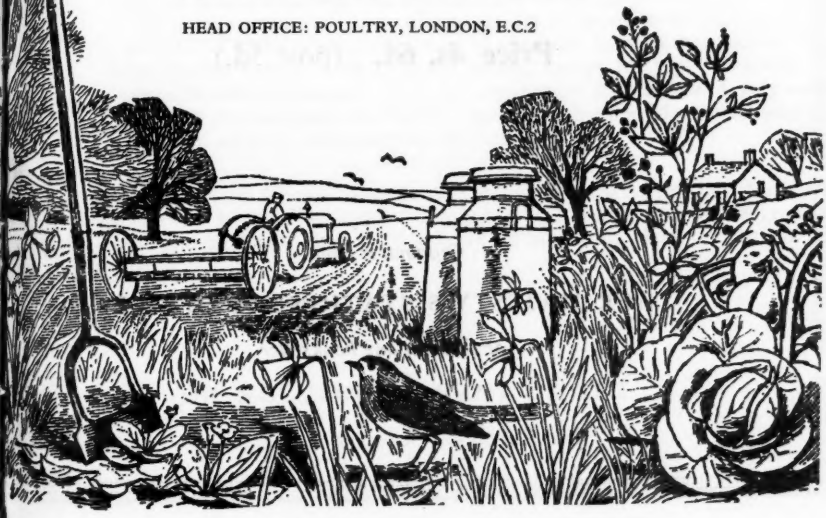

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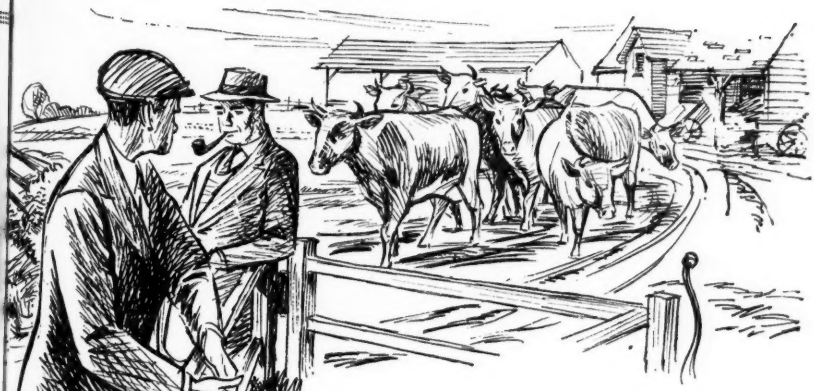

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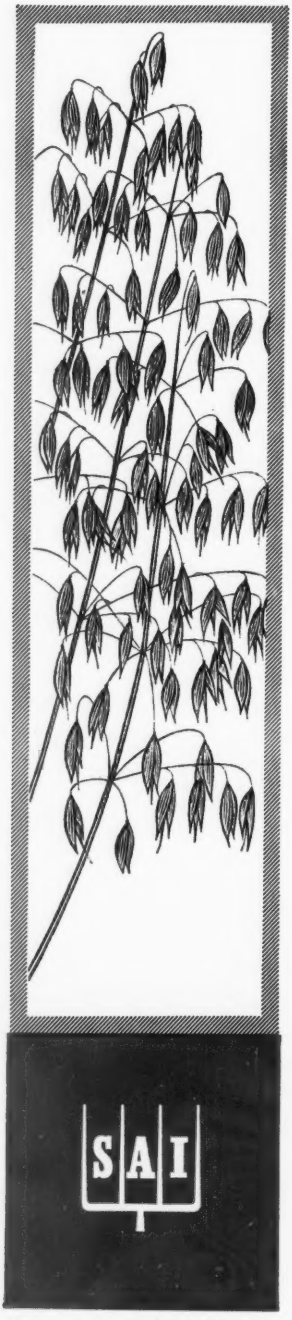

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